Boundary Hydroelectric Project (FERC No. 2144)

Study No. 17
Rare, Threatened, and Endangered (RTE)
Plant Species Inventory
Final Report

Prepared for
Seattle City Light

Prepared by
Kathryn Beck
Beck Botanical Services

and

Mary Clare Schroeder
Tetra Tech

March 2009

Correction page to Study 17, RTE Plant Species Inventory, as provided by SCL on February 12, 2009

1) p. 2, third bullet, *The Boundary Wildlife Preserve (BWP) (155 acres) and adjoining SCL-owned property (85 acres).*

Subsequent to completion of the final report, SCL discovered a discrepancy between the description of the study area for the “adjoining SCL-owned parcel” and the area that was surveyed during field studies. The BWP was mapped accurately in the study reports and the entire BWP was surveyed as planned; this discrepancy relates only to the "adjoining SCL-owned property."

Terrestrial field crews were working from an incorrect map of the parcel and thus, detailed field surveys took place on only 42 acres of the parcel. Regardless of this error, SCL believes that the conclusions presented in the final study report are still valid.

Additionally, the size of the “adjoining SCL-owned parcel” is 88 acres, not 85 acres.

TABLE OF CONTENTS

Appendices

List of Tables

List of Figures

This page intentionally left blank.

Study No. 17: Rare, Threatened, and Endangered (RTE) Plant Species Inventory Final Report Boundary Hydroelectric Project (FERC No. 2144)

1 INTRODUCTION

Study No. 17, the Rare, Threatened, and Endangered (RTE) Plant Species Inventory (RTE Plant Study), was conducted in support of the relicensing of the Boundary Hydroelectric Project (Project), Federal Energy Regulatory Commission (FERC) No. 2144, as identified in the Revised Study Plan (RSP; SCL 2007) submitted by Seattle City Light (SCL) on February 14, 2007, and approved by the FERC in its Study Plan Determination letter dated March 15, 2007. This report describes the field efforts, analyses, and determination of Project effects and represents the completion of the study.

2 STUDY OBJECTIVES

The goals of the RTE Plant Study were to determine the presence of RTE plants in the Project area, assess Project effects on these species, and direct management decisions related to RTE plant species.

Specific objectives of this study were as follows:

- Survey for and identify the RTE plant species occurring in the Project area.
- Map the location, distribution, and extent of RTE plant populations.
- Identify any threats to existing RTE plant populations (e.g., nearby infestations of invasive non-native species, erosion, herbivory) and their habitats, including potential Project effects.

The RTE Plant Study built on a 2005 reconnaissance level survey of RTE plants that was conducted in the Project vicinity to provide baseline information for the Pre-Application Document (PAD). The primary goal of the 2005 RTE survey was to confirm locations of historic and relatively recently mapped occurrences of RTE plant species from U.S. Forest Service (USFS) and the Washington State Department of Natural Resources (DNR), Washington Natural Heritage Program (WNHP) records. Results of these surveys were summarized in the PAD (SCL 2006). In 2006, a number of additional RTE plant populations were located and mapped during invasive plant species surveys. It was not in the scope of the 2005 and 2006 reconnaissance surveys to completely map known or new RTE plant populations or to produce sighting forms documenting the RTE populations; this work was conducted during 2007 and is reported herein.

3 STUDY AREA

The study area for the RTE Plant Study extended approximately 18 miles along the Pend Oreille River from the Box Canyon tailrace downstream to the U.S.-Canada border (Figure 3.0-1). Specifically, the study area encompassed the following:

- Downstream of Metaline Falls—The reservoir fluctuation zone under normal Project operations (forebay elevation 1,974–1,994 feet NAVD 88 [1,970–1,990 feet NGVD 29])[1] and the land within the FERC Project boundary (Project area). The Project area includes most Project facilities, the area 200 horizontal feet (i.e., along the ground surface, perpendicular to the shoreline) beyond the high water level (forebay elevation 1,994 feet NAVD 88 [1,990 feet NGVD 29]) along both reservoir shorelines, and the transmission line right-of-way (ROW) from the powerhouse to the Bonneville Power Administration interconnection.
- Upstream of Metaline Falls—The reservoir fluctuation zone (approximately 1,986–2,020 feet NAVD 88 [1,982–2,016 feet NGVD 29], based on hourly records from 1987 through 2005 at the U.S. Geological Survey [USGS] gage below Box Canyon Dam), and the land within approximately 200 horizontal feet beyond the high water level (approximately 2,020 feet NAVD 88 [2,016 feet NGVD 29]) along both reservoir shorelines extending to the FERC project boundary for the Box Canyon Project.[2, 3]
- The Boundary Wildlife Preserve (BWP) (155 acres) and adjoining SCL-owned property (85 acres).
- 100 feet around any Project works areas that extend outside the Project boundary.
- 50 feet along both sides of Project-related roads (Project-related roads are identified in Study 22, Land and Roads Study Revised Final Report, Table 5.2-1 and Figure 5.2-1 (2009a); 100 horizontal feet along both sides of the river from Boundary Dam to the U.S.-Canada border (approximately 0.9 mile).

The range of water surface levels recorded during the survey periods for this study is presented below; these ranges represent typical operating conditions for the period in which data were collected. Existing conditions at the time of surveys were considered adequate to acquire all data required for this study:

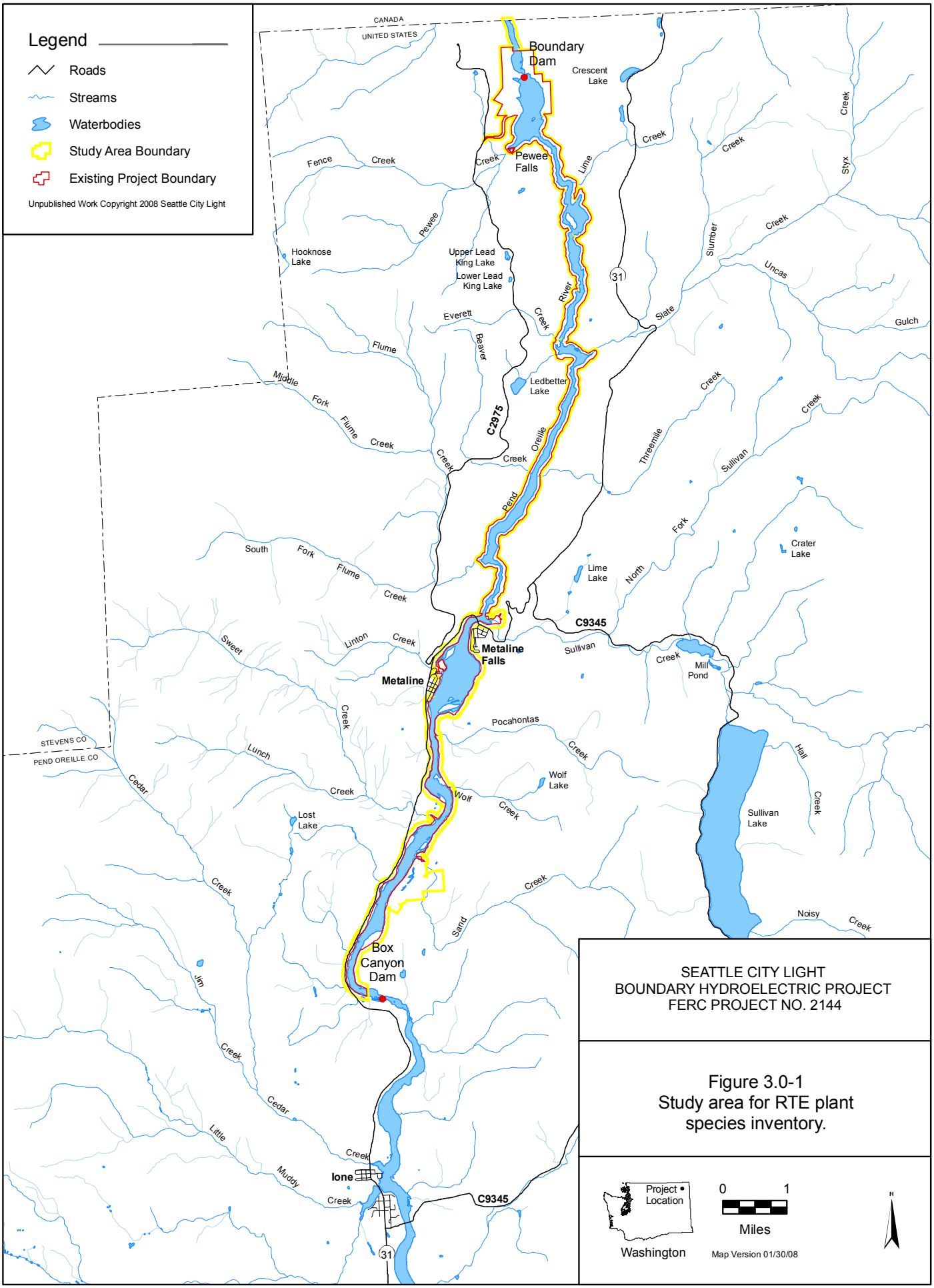
[1] SCL is in the process of converting all Project information from an older elevation datum (National Geodetic Vertical Datum of 1929 [NGVD 29]) to a more recent elevation datum (North American Vertical Datum of 1988 [NAVD 88]). As such, elevations are provided relative to both data throughout this document. The conversion factor between the old and new data is approximately 4 feet (e.g., the crest of the dam is 2,000 feet NGVD 29 and 2,004 feet NAVD 88).

[2] As indicated in this and other study reports in the Updated Study Report, SCL agreed it is appropriate to study the existing fluctuation range of the reservoir; however, for development of the Preliminary Licensing Proposal (PLP) and License Application, SCL will base its assessment of potential protection, mitigation, and enhancement measures on that portion of the fluctuation zone that is determined to be under the influence of Boundary Project operations, versus the effects of inflows and Metaline Falls that are beyond the control of the Project.

[3] Data for the riparian zone downstream of the Box Canyon Dam located within the FERC project boundary for the Box Canyon Project (FERC #2042) are included in this report; however, in the development of the Preliminary Licensing Proposal and License Application, SCL's assessment of potential protection, mitigation, and enhancement efforts will be limited to those effects that are determined to be under the influence of Boundary Project operations.

- From Box Canyon Dam to Metaline Falls—Elevation 1,988–2,003 feet NAVD 88 (1,984–1,999 feet NGVD 29), as measured at the USGS gage 12396500.
- From Metaline Falls to Boundary Dam—Elevation 1,987–1,993 feet NAVD 88 (1,983–1,989 feet NGVD 29), as measured at the SCL gage located in the Boundary forebay.

Note: The study area for the 2005 and 2006 RTE plant surveys was much larger than the study area for this RTE Plant Study (refer to the PAD [SCL 2006]). The 2005 and 2006 study area between Boundary Dam and Metaline Falls included the area between SR 31 on the east side of the reservoir and County Road 2975 on the west side of the reservoir. Between Metaline Falls and Box Canyon Dam, it also included the area between SR 31 on the west side of the reservoir and 0.25 mile east of the reservoir shoreline. A number of RTE plant populations located within the 2005 and 2006 reconnaissance study areas are outside of the 2007 study area and are not presented in this report.


Legend
Roads
Streams
Waterbodies
Study Area Boundary
Existing Project Boundary
Unpublished Work Copyright 2008 Seattle City Light
CANADA
UNITED STATES
Boundary Dam
Crescent Lake
Pewee Falls
Fence Creek
Pewee Creek
Hooknose Lake
Upper Lead King Lake
Lower Lead King Lake
Lime Creek
Styx Creek
Slumber Creek
Uncas Creek
Gulch
Slate Creek
River
31
Everett Flume
Beaver Creek
Ledbetter Lake
C2975
Middle Fork Flume Creek
Orelle Creek
Pend Oreille
Threemile Creek
Sullivan Creek
Crater Lake
Lime Lake
North Fork Sullivan Creek
Mill Pond
South Fork Flume Creek
C9345
Sweet Linton Creek
Metaline Falls
Metaline
Pocahontas Creek
Wolf Lake
Wolf Creek
Hall Creek
Sullivan Lake
STEVENS CO
PEND OREILLE CO
Lunch Creek
Cedar Creek
Lost Lake
Sand Creek
Noisy Creek
Box Canyon Dam
Jim Creek
Cedar Creek
Little Muddy Creek
Ione
C9345
31
SEATTLE CITY LIGHT
BOUNDARY HYDROELECTRIC PROJECT
FERC PROJECT NO. 2144
Figure 3.0-1
Study area for RTE plant species inventory.
Project Location
Washington
0
1
Miles
Map Version 01/30/08
N

4 METHODS

The RTE Plant Study included four tasks:

- Task 1: Information Update and Pre-Field Review
- Task 2: RTE Plant Survey
- Task 3: Documentation and Effects Assessment
- Task 4: Resolution of Outstanding Issues

4.1. Information Update and Pre-Field Review

For this study, RTE species were defined to include all taxa with federal or state protective status, specifically the following:

- *Federally Listed or Proposed Species*—Species that are listed and protected under the Endangered Species Act (ESA) of 1973, as Endangered or Threatened, or proposed for listing.
- *Federal Candidates*—Species for which the U.S. Fish and Wildlife Service (USFWS) has sufficient information on their biological status and threats to propose them as endangered or threatened under the ESA, but for which development of a proposed listing regulation has not occurred because of other higher priority listing activities. Candidate species receive no statutory protection under the ESA. However, the USFWS encourages the formation of partnerships to conserve these species.
- *State Status*—Species listed by the WNHP on an advisory basis as Endangered, Threatened, Sensitive, and Review List 1 and 2. Species on the Watch List were included only if they were also federally listed or USFS Sensitive.
- *USFS Sensitive Species*—Species on the Regional Forester's List of Sensitive Species for the Colville National Forest (USFS 2004, 2005a). The Regional Forester's List does not include species already protected under the ESA.
- *Bureau of Land Management (BLM) Sensitive Species*—Species on the Oregon and Washington BLM Special Status Species List (BLM 2005). The BLM list does not include species already protected under the ESA or state-listed as endangered or threatened.

The target RTE plant species list developed in 2006 for the RSP was updated in 2007 using information from the following sources:

- WNHP (online at http://www.dnr.wa.gov/nhp/)
- USFS Colville National Forest Botanist and Regional Forester's Sensitive Species List
- BLM Botanist and BLM Special Status Species Lists
- USFWS, Spokane Office

The update resulted in a complete and current RTE plant list with current status, a description of typical habitat, and an assessment of whether potential habitat is present in the study area. The assessment of potential habitat was based on the vegetation cover types produced for the PAD (SCL 2006) and the elevation range in the study area.

Prior to beginning field surveys, botanists reviewed the morphological characteristics of target RTE plant species, in particular the 10 non-vascular species, to develop search images to improve detection and recognition abilities. This included reviewing similar species that are closely related or otherwise difficult to distinguish from the target species. It also included collecting information on diagnostic vegetative, floral, and fruit characteristics, and obtaining dichotomous keys for some taxa to aid in field identification. In addition, USFS and WNHP documentation for RTE plant populations that were not relocated during the 2005 and 2006 reconnaissance surveys were obtained and reviewed (where available).

A meeting was held in March 2007 with Kathy Ahlenslager, botanist for the USFS Colville National Forest; Kathryn Beck, botanist; Michele Lynn, SCL Terrestrial Resources Project Manager; and Rich Dwerlkotte, EDAW botanist, to discuss an RTE plant survey documentation protocol that would meet USFS standards and be completed efficiently. The discussion primarily covered what would constitute an element occurrence on USFS land and how RTE plant occurrences on USFS lands would be recorded. It was agreed that RTE plant occurrences on USFS lands would be recorded as distinct populations or element occurrences even though ecologically many could be combined with populations on land under other ownership.

New RTE plant occurrences recorded during the 2007 survey were identified as new populations or combined with existing element occurrences using criteria published by NatureServe (2004). This habitat-based guidance is based primarily on the distance between occurrences, whether RTE plants share the same riparian/shore system, and how contiguous suitable habitat is between occurrences.

4.2. RTE Plant Survey

RTE plant surveys were conducted June 4–8, June 25–29, July 17–22, August 14–18, and September 2–4, 2007. These weeks were chosen so surveys would occur during periods throughout the growing season to capture the range of plant development and phenology required to increase the likelihood of observing and positively identifying RTE plant species. Many areas were visited more than once to adequately search for early- and late-blooming species. A site visit was conducted July 21–23, 2008, to evaluate potential Project-related effects of erosion and recreation on RTE plant populations; no RTE plant surveys were conducted in 2008.

Surveys for RTE vascular plants were conducted using the "intuitive controlled method," whereby study area habitats with high potential to support these species were surveyed with greater intensity than areas with low potential (Nelson 1985). High potential habitats were identified based on the existing cover type map (SCL 2006), the locations of documented element occurrences from the SCL Geographic Information System (GIS), and field observations of habitat features that were too small to map (e.g., seeps). Most of the RTE plant survey was conducted by walking; however, areas too steep to walk were surveyed from a boat using 7x50 binoculars.

RTE vascular plants were identified using *Flora of the Pacific Northwest* (Hitchcock and Cronquist 1973) and WNHP (2007). A variety of additional sources were utilized to verify

tentative species identification, including other floras, published papers, and consultation with appropriate taxonomic specialists. Plant collections were made when it was deemed necessary to identify a plant. Most pressed collections will eventually be deposited at the University of Washington herbarium (WTU). In addition, a comprehensive list of all vascular plant species observed and identified during the RTE plant survey was compiled. Finally, after the Updated Study Report is finalized and submitted to FERC, SCL will submit all RTE sighting forms to the WNHP.

Survey protocols for non-vascular plants (mosses and lichens) followed those for vascular plants found in the USFS *Threatened, Endangered and Sensitive Plant Survey Field Guide* and field form (USFS 2005a). During the surveys, botanists looked for textural differences in the cover of non-vascular plants on trees and rocks. Habitat features with observed textural differences were investigated further for the presence of RTE non-vascular plants. Particular attention was given to mossy rocks, large tree trunks, and downed trees when they were encountered. Because so little is known about non-vascular plants in the study area, lichen specimens were collected and provided to the USFS for a baseline reference collection.

4.3. Documentation and Effects Assessment

The RTE plant information collected during the 2005 and 2006 reconnaissance surveys and reported in the RSP (SCL 2007) served as the starting point for the documentation of RTE plants during the 2007 surveys. Mapped data (new populations) from the 2007 surveys were digitized using ESRI's GIS ArcMap software. The spatial data were used to amend the RTE plant shape files from the 2005 and 2006 reconnaissance surveys and to create a final map depicting the extent and location of each rare plant population in the study area. The boundaries of previously known populations were revised as necessary, based on observations made during the 2007 survey.

A population may consist of one or many subpopulations, each of which is comprised of a discretely mapped polygon. The terms polygon and subpopulation are used interchangeably in this report. Nearly all of the previously known element occurrences in the study area were significantly enlarged and/or were combined with other subpopulations; for the sake of clarity, these units will be referred to as "populations" in this report.

In the context of this report, an element occurrence or "occurrence" refers to RTE populations that were a part of the WNHP or USFS RTE plant databases, whereas a "population" refers to RTE sites newly identified by SCL during the 2005, 2006, or 2007 RTE plant surveys. These new populations will become element occurrences when they are entered into the WNHP and USFS databases and given unique tracking numbers.

Population data were collected in the field for both new and previously known RTE plant sites. The location and extent of each RTE plant polygon was delineated on the Project's ortho-photographs, and photographs were taken of the plants and their habitats. The NatureServe (2004) criteria were used to determine if each new RTE plant location should be mapped as a geographic extension of an existing element occurrence or population, or as a new population.

A comprehensive list of all vascular plant species observed and identified in the study area during the RTE surveys is provided in Appendix 1. Appendix 2 contains a list of all of the RTE plants found during the surveys, designations for populations and subpopulations, tracking status information relative to previous surveys, river mile locations of polygons, ownership, acres, and general descriptive comments.

The WNHP Rare Plant Sighting Form and Instructions were used for collecting population attribute data on non-USFS land, including SCL, DNR, BLM, and private lands (see Appendix 2 in the RSP). These forms were filled out for all new and previously documented RTE plant populations in the study area. The completed forms are provided in Appendix 3 and will be submitted to the WNHP.

Documentation of surveys conducted on USFS lands followed the protocol described in *Threatened, Endangered, and Sensitive Plants Survey Field Guide* (USFS 2005a). The RTE Plant Survey Field Form was used to document the dates and parameters of the surveys on USFS land. The USFS Element Occurrence Field Form (USFS 2005b) was used for collecting data on population attributes for each RTE plant population on USFS land. The completed USFS field forms are provided in Appendix 4 and will be submitted to the USFS. Documentation of RTE plant locations is considered confidential and will be distributed only to the USFS, WNHP, and other agencies, as appropriate.

Each RTE plant species occurrence was evaluated in the field for potential Project-related impacts and other threats. Data recorded included location relative to the reservoir fluctuation zone, recreation areas, and/or Project facilities; evidence of inundation, grazing, trampling, insect infestations, or disease; and proximity to erosion and/or invasive species infestations. Although a great deal of effort was made to interpret a wide variety of site conditions while in the field, existing and potential impacts to RTE plant populations were not always evident during a site visit; conclusions were drawn based on the conditions observed at the time of the surveys and represent the best efforts possible.

4.4. Resolution of Outstanding Issues

During the 2005 and 2006 surveys, three issues related to RTE plant taxonomy and identification were identified for further research and resolution. These issues and the subsequent resolution follow:

- Orange balsamroot (*Impatiens aurella*) had unresolved taxonomic issues from the 2005 field season. In 2007, several flowering plants were examined and evaluated using a dichotomous key to species of the genus *Impatiens* in the Pacific Northwest (Zika 2006). Plants in the genus *Impatiens* in the study area were determined to be orange balsamroot. Orange balsamroot is a WNHP Review Group 1 species (WNHP 2007).
- The identification of yellow sedge (*Carex flava*) observed along the Project reservoir shoreline during the 2005 field season (PAD Figure 4.3.6, Occurrence CAFL-1; SCL 2006) was made when the perigynia were not quite mature, thus the identification could not be confirmed at that time. In 2007, inflorescences were collected when the perigynia were mature, and their identity as yellow sedge was confirmed using

Hitchcock and Cronquist (1973) and the Flora of North America dichotomous keys to species of the genus *Carex*, Section Ceratocystis (Crins 2002).

- Purple meadowrue (*Thalictrum dasycarpum*) occurrences documented during the 2005 reconnaissance survey were identified using Hitchcock and Cronquist (1973); however, some specimens seemed to have characteristics that overlapped with western meadowrue (*Thalictrum occidentale*). During the 2007 surveys, the Flora of North America dichotomous key to species of the genus *Thalictrum* was used to identify plants (Park and Festerling 1997) and confirm the identity of purple meadowrue in the study area.

5 RESULTS

5.1. Information Update and Pre-Field Review

The updated target list of RTE plant species with the potential to occur in the study area includes 60 vascular plant, 7 lichen, and 3 moss species (Table 5.1-1). Compared to the 2006 target list, 5 additional RTE vascular plants are included on the 2007 list.

Table 5.1-1. RTE plant species documented or suspected to occur in the study area.

Scientific Name[1]	Common Name	USFWS Status[2]	USFS Status[3]	BLM Status[4]	WNHP Status[5]	Is Potential Habitat Present in Study Area?	Habitat Requirements/Information
VASCULAR PLANTS							
Antennaria corymbosa	Meadow pussy-toes	None	S	BA	T	No bogs	Bogs. Elev. 5,000 feet.
Antennaria parvifolia	Nuttall's pussy-toes	None	S	BA	S	Yes	Dry open areas, on sandy or gravelly riverbanks, openings of Ponderosa pine forests. Elev. 1,900 to 2,600 feet.
Astragalus microcystis	Least bladdery milk-vetch	None	S	BA	S	Yes	Open woods near shorelines, riverbanks, floodplains. Elev. 1,900 to 2,100 feet.
Botrychium ascendens	Triangular-lobed moonwort	None	S	BA	S	Yes	Dry meadows. Elev. 3,000 to 3,400 feet.
Botrychium crenulatum	Crenulate moonwort	None	S	BA	S	Yes	Western redcedar/western hemlock forests, stream banks, floodplains. Elev. 2,030 to 4,600 feet.
Botrychium hesperium	Western moonwort	None	S	BA	T	Yes	Dry to moist meadows. Elev. 2,760 to 6,300 feet.
Botrychium lineare	Skinny moonwort	None	S	FC	T	Yes	Western redcedar/western hemlock forests, stream banks, floodplains. Elev. 2,000 to 4,000 feet.
Botrychium paradoxum	Two-spiked moonwort	None	S	BA	T	Yes	Meadows, perennial and intermittent streams. Elev. 2,500 to 3,600 feet.
Botrychium pedunculosum	Stalked Moonwort	None	S	BA	S	Yes	Dry to moist meadows, perennial streams. Elev. 2,500 to 3,300 feet.
Carex capillaris	Hair-like sedge	None	S	BA	S	Yes	Stream banks, wet meadows, wet ledges, marshy lake shores. Elev. 2,800 to 6,500 feet.
Carex comosa	Bristly sedge	None	S	BA	S	Yes	Marshes, lake shores, and wet meadows. Elev. 50 to 2,000 feet.
Carex dioica	Yellow bog sedge	None	S	BA	S	No sphagnum bogs	Sphagnum bogs, forested wetlands, and other wet marshy areas. Elev. 2,600 to 3,800 feet.

Table 5.1-1, continued…

Scientific Name[1]	Common Name	USFWS Status[2]	USFS Status[3]	BLM Status[4]	WNHP Status[5]	Is Potential Habitat Present in Study Area?	Habitat Requirements/Information
Carex flava	Yellow sedge	None	None	BA	S	Yes	Wet meadows, forested wetlands, bogs, and shores of streams and lakes. Elev. 2,000 to 4,300 feet.
Carex foenea	Bronze sedge	None		BA	S	Yes	Standing water or moist ground near lakeshores and open areas.
Carex hystericina	Porcupine sedge	None	S	BA	W	Yes	Wet depressions, along creek drainages and hillside seeps. Elev. 500 to 2,600 feet.
Carex magellenica spp. irrigua	Boreal bog sedge	None		BA	S	Yes	Fens, bogs, shady wet meadows, shrub wetlands and marshes.
Carex praeceptorum	Teacher's sedge	None	None	BT	R1	No, elev. not high enough	Wet meadows and areas at higher elevations in mountains.
Carex rostrata	Beaked sedge	None	S	BA	S	No bogs or fens	Bogs and fens. Elev. 4,600 to 5,000 feet.
Carex saxatilis var. *major*	Russet sedge	None	S	BA	W	Yes	Wet meadows and margins of lakes and streams.
Carex sychnocephala	Many-headed sedge	None	S	BA	S	Yes	Moist or wet ground adjacent to marshes or along lake shores. Substrates vary from rather rocky to sandy and silty soils.
Carex tenera var. tenera	Quill sedge	None			T	Yes	Dry to moist open forests and meadows.
Centunculus minimus	Chaffweed	None	None	None	R1	Yes	Moist ground, ephemeral wet areas elev. ~800 feet.
Chrysosplenium tetrandrum	Northern golden carpet	None	S	BA	S	Yes	Perennial and intermittent streams, seeps in rock outcrops. Elev. 2,000 to 4,000 feet.
Cicuta bulbifera	Bulb-bearing water-hemlock	None	S	BA	S	Yes	Edges of marshes, lake margins, in bogs, wet meadows, shallow standing water; slow moving streams, hummocks, and floating mats. Elev. 240 to 3,700 feet.
Cryptogramma stelleri	Steller's rock-brake	None	S	BA	S	Yes	Cliffs. Elev. 300 to 3,500 feet.
Cypripedium parviflorum	Yellow lady's-slipper	None	S	BS	T	Yes	Perennial streams on limestone rock under mixed conifer forest. Elev. 2,300 to 2,700 feet.

Table 5.1-1, continued…

Scientific Name[1]	Common Name	USFWS Status[2]	USFS Status[3]	BLM Status[4]	WNHP Status[5]	Is Potential Habitat Present in Study Area?	Habitat Requirements/Information
Dryas drummondii	Yellow mountain-avens	None	S	BA	S	Yes	In crevices of steep, rocky, dry cliffs, and on limestone rock along rivers. Elev. 1,900 to 6,800 feet.
Dryopteris carthusiana	Toothed wood fern	None		None	R1	No	In Washington, sphagnum swamps.
Dryopteris cristata	Crested shield-fern	None	S	BA	S	Yes	Wet meadows, forested wetlands. Often found on hummocks, downed woody debris or at the base of deciduous shrubs, often with alder. Elev. 2,100 to 4,100 feet.
Eriophorum viridicarinatum	Green keeled cotton-grass	None	S	BA	S	No fens, elev. too low	Fens and marshes. Elev. 2,900 to 4,650 feet.
Gaultheria hispidula	Creeping snowberry	None	S	BA	S	No sphagnum wetlands	Sphagnum wet lands or moist areas in coniferous woods. Elev. 2,960 to 3,360 feet.
Geum rivale	Water avens	None	S	BA	S	Yes	Wet meadows, bogs, riparian zones along perennial streams and moist old pastures. Does not occur under heavy shrub cover. Elev. 2,500 to 6,400 feet.
Hierochloe odorata	Common northern sweetgrass	None	None	None	R1	Yes	Moist soil of low montane and subalpine slopes and meadows.
Hypericum majus	Canadian St. John's-wort	None	S	BA	S	Yes	Along rivers, ponds, lakesides or other low, wet places; elev. 100 to 2,300 feet.
Impatiens aurella	Orange balsam	None	None	BT	R1	Yes	Moist, open or shaded habitats.
Lobelia kalmii	Kalm's lobelia	None	S	BS	E	No marl or peat bogs	Marl or peat bogs, along shores and in other wet places.
Lomatium sandbergii	Sandberg desert-parsley	None	None	None	R1	No, elev. too low	Open, rocky places at moderate to higher, subalpine habitats.
Lycopodiella inundata	Bog clubmoss	None	S	BA	S	No sphagnum bogs	Mostly in sphagnum bogs, seldom in other very wet places. Elev. 1,800 feet.

Table 5.1-1, continued…

Scientific Name[1]	Common Name	USFWS Status[2]	USFS Status[3]	BLM Status[4]	WNHP Status[5]	Is Potential Habitat Present in Study Area?	Habitat Requirements/Information
Lycopodium dendroideum (=Diphasiastrum alpinum)	Treelike clubmoss	None	S	BA	S	Yes	Rock outcrops, talus or boulder fields, significant moss and organic debris. Between a meadow or wetland and adjacent forest; near base of large boulders. Elev. 800 to 3,600 feet.
Muhlenbergia glomerata	Marsh muhly	None	S	BA	S	Yes	Stream banks, meadows, marshes, bogs, and shores of lakes and ponds. Elev. 2,900 to 3,500 feet.
Ophioglossum pusillum	Adder's-tongue	None	S	BS	T	Yes	Moist meadows, pastures, old fields, roadside ditches, and floodplain woods in seasonally wet, rather acid soil. Elev. 40 to 3,200 feet.
Penstemon wilcoxii	Wilcox's penstemon	None	None	None	S	Yes	Open or wooded areas, sometimes in rocky substrates in foothills and middle elevations.
Physaria didymocarpa var. *didymocarpa*	Common twinpod	None	S	BA	S	Yes	A variety of habitats, including river gravel bars, steep shale outcrops, rocky flats, gravelly prairies, talus slopes, dry hillsides, and road cuts. Elev. 2,000 feet.
Platanthera obtusata	Small northern bog orchid	None	S	BA	S	Yes	Damp or wet places in forests, marshes, bogs, meadows, and along stream banks. Areas with Engelmann spruce and/or western redcedar. Elev. 800 to 5,000 feet.
Salix candida	Hoary willow	None	S	BA	T	No fens	Fens. Elev. 2,400 to 3,000 feet.
Salix maccalliana	Maccall's willow	None	S	BA	S	No bogs or fens	Bogs and fens. Elev. 2,400 to 3,000 feet.
Salix pseudomonticola	Serviceberry willow	None	S	None	None	No fens or bogs	Fens and bogs. Elev. 2,900 feet.
Sanicula marilandica	Black snake-root	None	S	BA	S	Yes	Moist low grounds such as meadows, riparian floodplains, moist woods and marsh edges. Elev. 1,500 to 2,900 feet.
Scutellaria angustifolia spp. *micrantha*	Narrowleaf skullcap	None	None	None	R1	Yes	In a variety of open, moist or dry, often rocky habitats east of the Cascade Range.

Table 5.1-1, continued…

Scientific Name[1]	Common Name	USFWS Status[2]	USFS Status[3]	BLM Status[4]	WNHP Status[5]	Is Potential Habitat Present in Study Area?	Habitat Requirements/Information
Sisyrinchium montanum	Strict blue-eyed-grass	None	None	None	T	No, elev too high	Steep west-facing slopes associated with small seeps/springs; elev. 700 feet.
Sisyrinchium septentrionale	Northern blue-eyed grass	None	S	BA	S	Yes	Primarily in open, wet meadows, sometimes in association with perennial streams or in a mosaic of forested wetlands. Elev. 2,200 to 3,850 feet.
Spartina pectinata	Prairie cordgrass	None	S	BA	S	Yes	Wet areas such as swales, edges of marshes and ponds, and along streams and riverbanks, in both fresh and saltwater. Elev. 2,000 feet.
Spiranthes diluvialis	Ute ladies'-tress	FT	FT	FT	E	Yes	Stabilized gravel bars that are moist throughout the growing season and inundated early in the growing season; old oxbows, riparian edges, high flow channels, and moist-wet meadows along perennial streams; elev. 720–1,500 feet.
Subularia aquatica	Water awlwort	None		None	R1	Yes	Submerged beneath shallow water at the margins of freshwater lakes, ponds and stream banks.
Teucrium canadense spp. *viscidum*	Woodsage	None	S	None	W	Yes	Wet areas around lakes and stream banks in low areas. Elev. 0 to 2,300 feet.
Thalictrum dasycarpum	Purple meadowrue	None	S	BA	S	Yes	Deciduous riparian woods, damp thickets, swamps, wet meadows, often adjacent to and/or within the floodplain. Elev. 200 to 2,200 feet.
Utricularia intermedia	Flat-leaved bladderwort	None	None	BA	S	No, elevation not high enough	Shallow ponds, slow-moving streams, and wet sedge or rush meadows. Elev. 4,000 feet.
Utricularia minor	Lesser bladderwort	None	None	BT	R1	Yes	Shallow, standing, or slow-moving water.
Vaccinium myrtilloides	Velvet-leaved blueberry	None	S	BA	S	Yes	Western redcedar/ western hemlock forests. Elev. 2,000 to 3,000 feet.
Viola renifolia	Kidney-leaved violet	None	S	BT	S	Yes	Moist lowland forests. Elev. 2,270 to 4,355 feet.

Table 5.1-1, continued…

Scientific Name[1]	Common Name	USFWS Status[2]	USFS Status[3]	BLM Status[4]	WNHP Status[5]	Is Potential Habitat Present in Study Area?	Habitat Requirements/Information
NON-VASCULAR PLANTS—LICHENS[6]							
Dermatocarpon luridum	Brook lichen	None	S	None	P1	Yes	Aquatic; on rocks, boulders, and bedrock in streams, rivers, or seeps, usually submerged to inundated most of the year.
Leptogium burnetiae var. *hirsutum*	Jellyskin	None	S	None	P2	Yes	Typically epiphytic on trees but also on decaying rocks and mosses.
Leptogium cyanescens	Blue jellyskin	None	S	None	None	Yes	Bark of conifers and hardwood trees and logs, mossy rocks in cool, moist micro-sites.
Nephroma bellum	Naked kidney lichen	None	S	None	None	Yes	On branches and twigs of trees, especially conifers. Also on mossy rocky in humid forests.
Peltigera neckeri	Black saddle lichen	None	S	None	None	Yes	Mossy logs, soil, and tree bases in wet forest habitats.
Peltigera pacifica	Fringed pelt	None	S	None	None	Yes	Mossy logs, soil, and tree bases in wet forest habitats.
Tholurna dissimilis	Urn lichen	None	S	None	P1	No, not subalpine	On twigs and branches of exposed conifers in humid subalpine habitats.
NON-VASCULAR PLANTS—MOSSES[7]							
Schistostega pennata	Luminous moss	None	S	None	None	Yes	Damp acidic rock, soil, and decaying wood in dark places, rock crevices or overhangs, animal burrows, on shaded banks, in crevices of root balls or fallen trees or around tree roots in dark, dense forests.
Scouleria marginata	Splashzone moss	None	S	None	None	Yes	Semi-aquatic; on rocks in the spray-zone of streams and waterfalls, typically submerged at least part of the year.

Table 5.1-1, continued…

Scientific Name[1]	Common Name	USFWS Status[2]	USFS Status[3]	BLM Status[4]	WNHP Status[5]	Is Potential Habitat Present in Study Area?	Habitat Requirements/Information
Tetraphis geniculata	Tetaphis moss	None	S	None	None	Yes	Moist conifer forest with large downed logs. Found on cut or broken ends or low sides of decay class 3, 4, or 5 rotted logs or stumps and occasionally on peaty banks in moist conifer forests from sea level to subalpine elevations.

Notes:

1 Species names listed in **bold** indicate those documented in the study area.

2 USFWS Classification: FT=Listed as Threatened, likely to become endangered (WNHP 2007).

3 USFS Regional Forester's Sensitive Species, Region 6, updated July 2004 (USFS 2004). S = Sensitive.

4 Bureau of Land Management (BLM) Special Status Species, updated March 2005 (BLM 2005). BLM Special Status Species Categories:
BS = Bureau Sensitive – Nominated by BLM District Managers; must be listed by WNHP to be eligible.
BA = Bureau Assessment – Species known or suspected on BLM land that are not federally listed, state listed, or BS and that are listed by the WNHP but not eligible as BS.
BT = Bureau Tracking – All species known or suspected on BLM land that are not federally listed, state listed, BS, or BA, and that are WNHP Review species or Watch species.
FC = Federal Candidate Species in Oregon and Washington.
FT = Federal Threatened Species in Oregon and Washington.

5 State Status: WNHP (2007) provides the following explanation of state status:
E = Endangered taxa are at critically low levels or their habitats have been degraded or depleted to a significant degree presenting the danger of becoming extinct or extirpated from Washington within the foreseeable future if factors contributing to their decline continue.
T = Threatened are likely to become Endangered in Washington within the foreseeable future if factors contributing to population decline or habitat degradation or loss continue.
S = Sensitive taxa are vulnerable or declining and could become Endangered or Threatened in the state without active management or removal of threats.
R = Review taxa are either R1 = Taxon in need of additional field work before a status can be assigned, or R2 = Taxon with unresolved taxonomic questions.
W = Watch List taxa that are less at risk in Washington than previously assumed.

6 WNHP lichen list is in the process of being revised; state status is based on 1997 list (WNHP 1997-2003). Priority status groups were developed by scientists using the same criteria as those used for vascular plants: occurrence pattern, vulnerability, threats, degree of protection, and taxonomy.

7 WNHP has not assigned mosses to priority groups due to lack of information (WNHP 2007).

5.2. RTE Plant Surveys

Surveys conducted in 2007 documented 15 vascular RTE plant species in the study area. These species occurred in 206 polygons or subpopulations, which were combined into 53 populations (Table 5.2-1). A comprehensive list of all vascular plant species observed and identified in the study area during the RTE surveys is provided in Appendix 1.

Table 5.2-1. RTE plant populations and polygons (subpopulations) delineated during 2007 surveys.

Taxon	No. of Populations	No. of Polygons	GRank[1]	USFWS[2]	USFS[2]	BLM[2]	WNHP[2]
Astragalus microcystis (least bladdery milk-vetch)	5	17	G5	None	S	BA	S
Carex capillaris (hair-like sedge)	1	1	G5	None	S	BA	S
Carex flava (yellow sedge)	2	18	G5	None	None	BA	S
Carex krausei ssp. *porsildiana* (Porsild's sedge)	1	1	G5	None	None	None	R2
Cryptogramma stelleri (Steller's rock-brake)	4	11	G5	None	S	BA	S
Dryas drummondii (yellow mountain-avens)	4	38	G5	None	S	BA	S
Hierochloe odorata (common northern sweetgrass)	2	3	G5	None	None	None	R1
Hypericum majus (Canadian St. John's-wort)	1	5	G5	None	S	BA	S
Impatiens aurella (orange balsam)	8	8	G4?	None	None	BT	R1
Muhlenbergia mexicana var. *mexicana* (wirestem muhly)	1	24	G5	None	None	None	R1
Ophioglossum pusillum (adder's-tongue)	2	2	G5	None	S	BS	T
Sanicula marilandica (black snake-root)	8	10	G5	None	S	BA	S
Sisyrinchium septentrionale (northern blue-eyed grass)	2	3	G3G4	None	S	BA	S
Thalictrum dasycarpum (purple meadowrue)	7	60	G5	None	S	BA	S
Viola renifolia (kidney-leaved violet)	5	5	G5	None	S	BT	S
Totals	**53**	**206**					

Notes:

1 Global Rank (GRank)—Global Rank characterizes the relative rarity or endangerment of the element worldwide. Two codes (e.g., G1G2) represent an intermediate rank.
G3 = Either very rare and local throughout its range or found locally in a restricted range (21 to 100 occurrences)
G4 = Apparently secure globally
G5 = Demonstrably secure globally
? = Questionable

2 See relevant notes under Table 5.1-1.

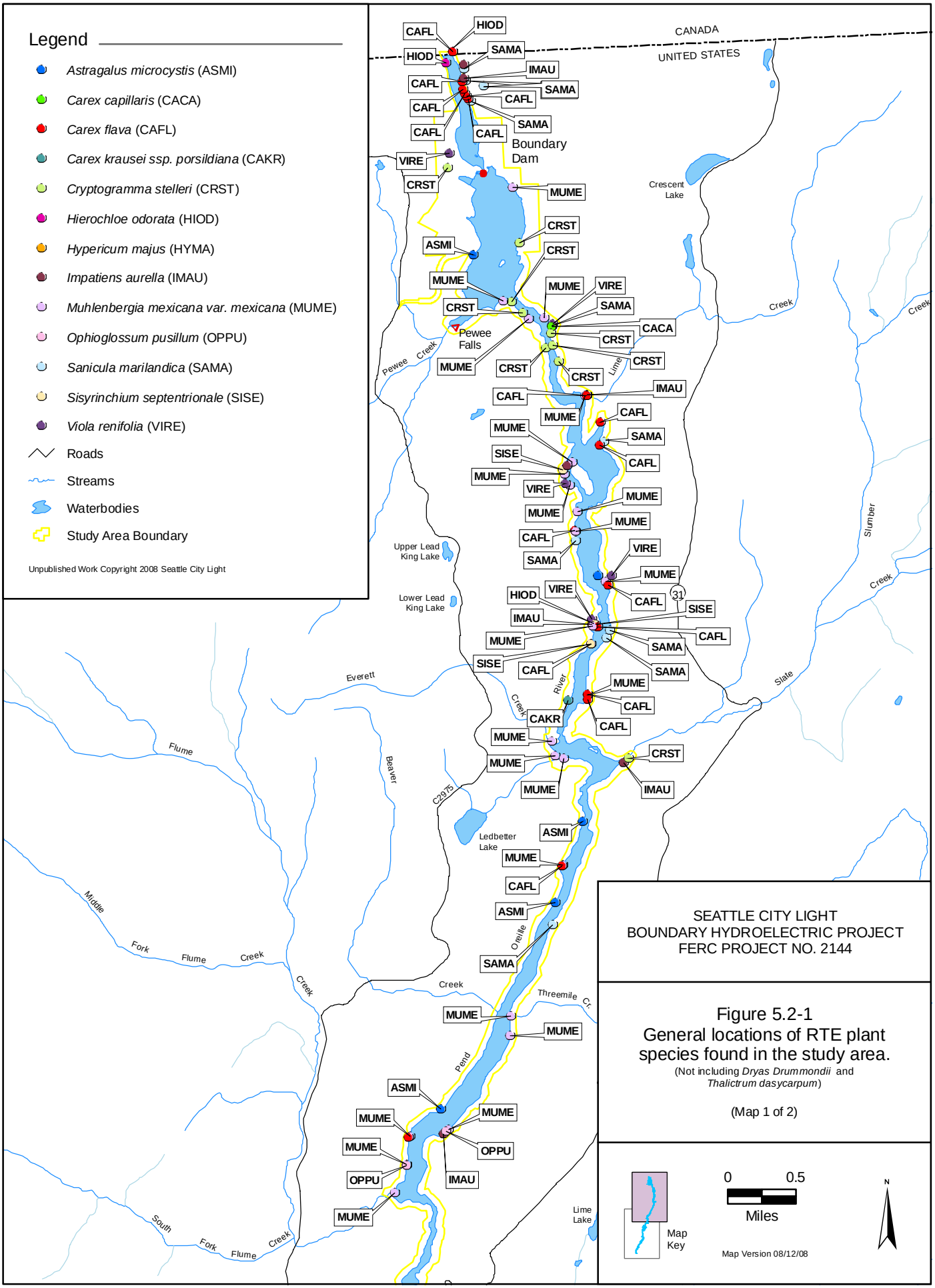
Table 5.2-1 also includes the Global Rank (GRank) to characterize the relative rarity or endangerment worldwide of each RTE plant species located in the study area. In addition, the USFWS, USFS, BLM, and WNHP status of each RTE plant is summarized (WNHP 2007).

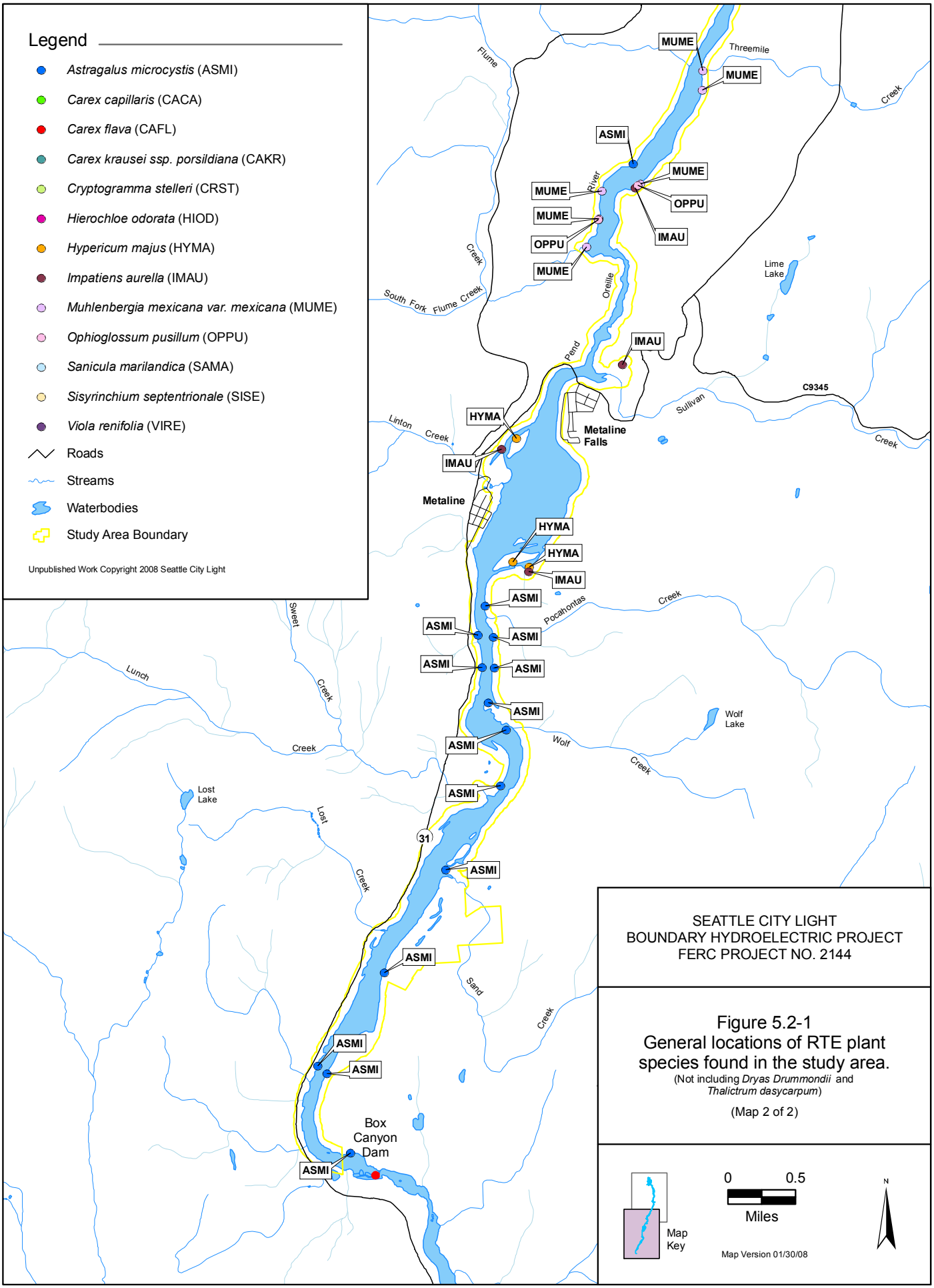
The locations of all RTE plant species populations are shown in Figures 5.2-1 and 5.2-2. Figure 5.2-1 displays the locations of 13 RTE species excluding populations of yellow mountain-avens and purple meadowrue. Because of the numerous subpopulations of these two species, they are displayed separately in Figure 5.2-2.

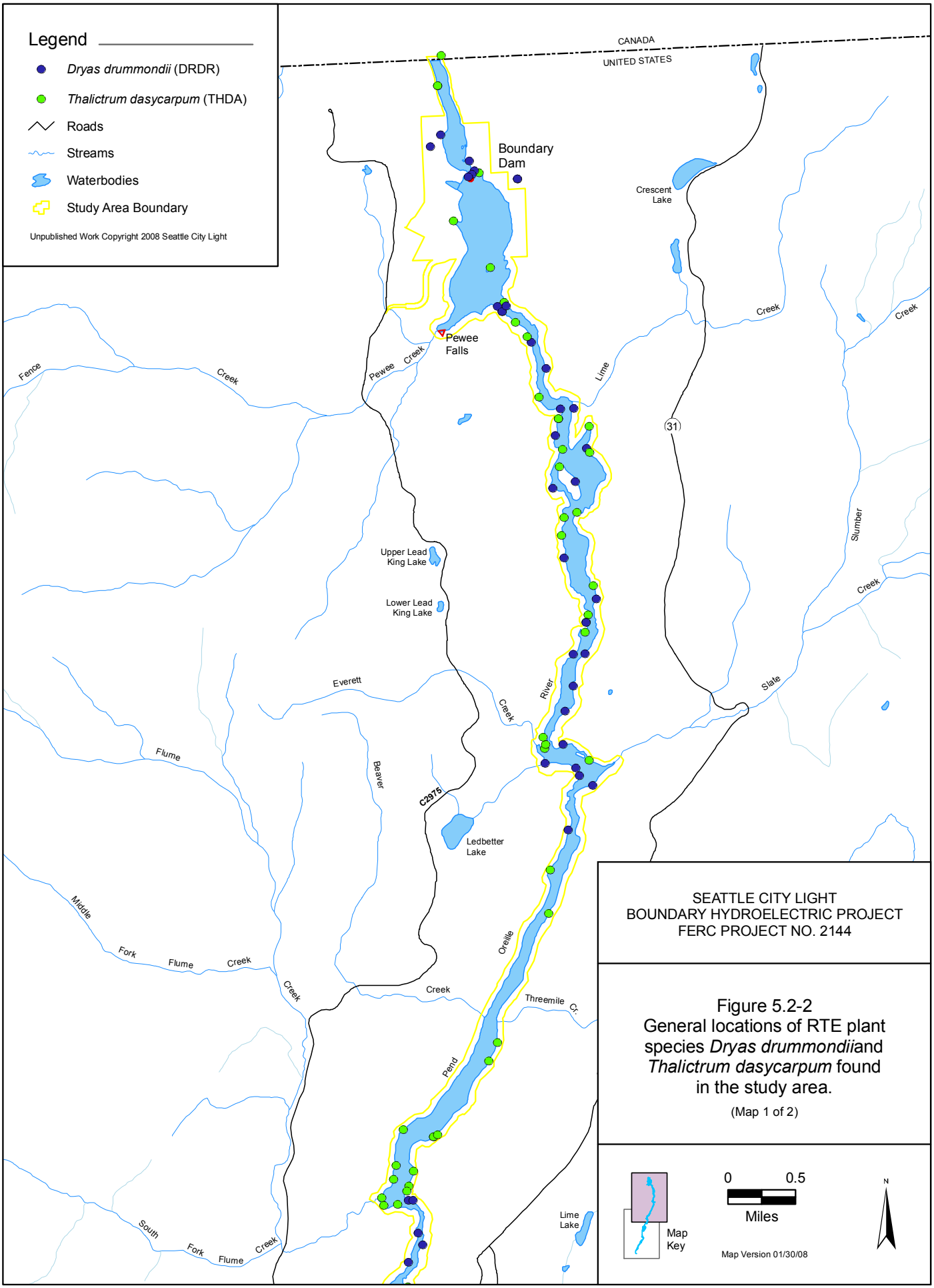
Appendix 2 contains a list of all of the RTE plants found during the surveys, designations for populations and subpopulations, tracking status information relative to previous surveys, Project river mile (PRM) locations, ownership, acres, and general descriptive comments. The completed WNHP sighting forms for RTE plant populations on BLM, DNR, SCL, and private lands are contained in Appendix 3. Completed element occurrence field forms for RTE plant populations on USFS lands are contained in Appendix 4. Appendix 5 contains maps of all RTE plant populations and subpopulations located in the study area during 2007.

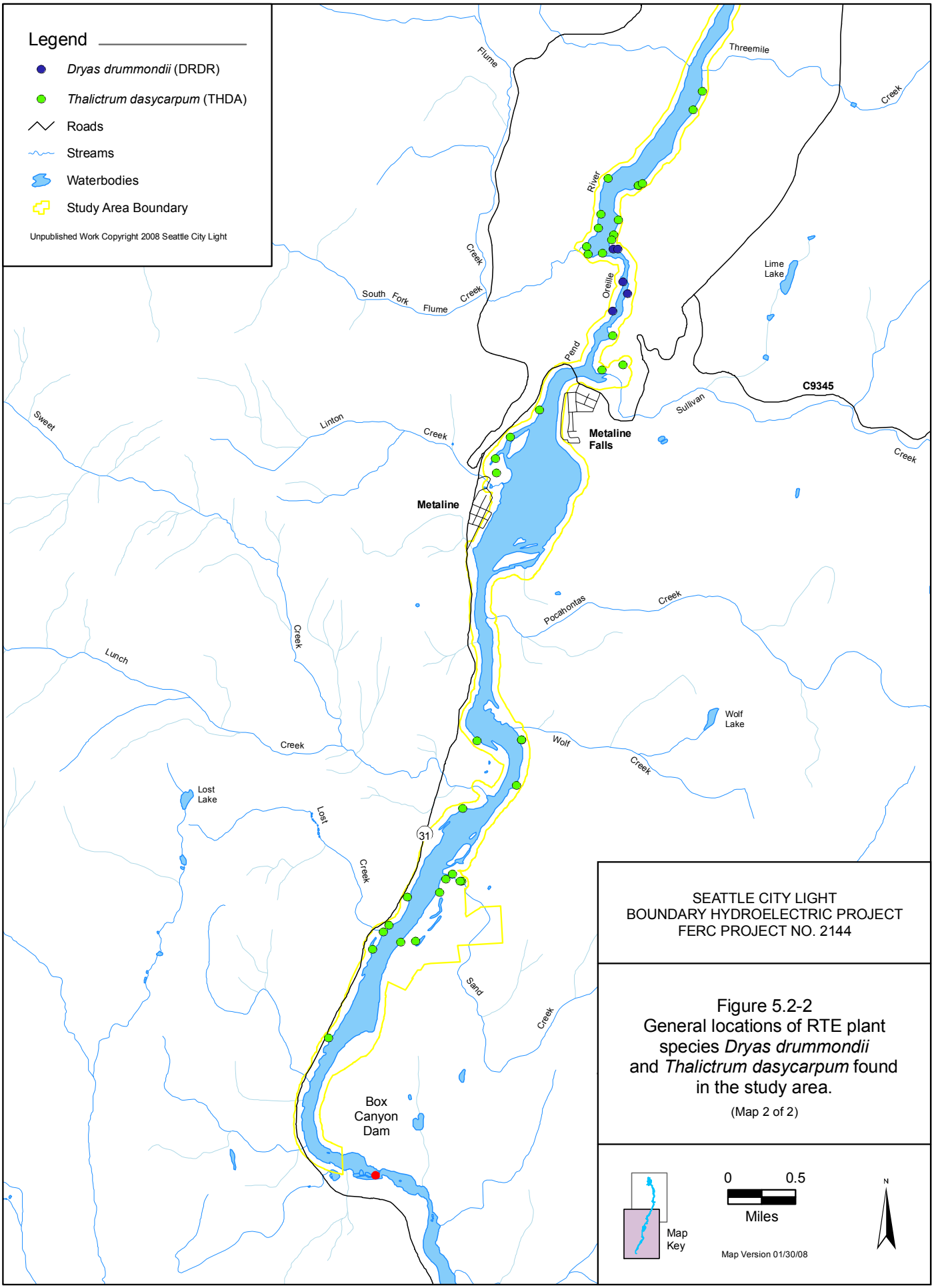
The 206 polygons or subpopulations of RTE plants documented during this survey represent 159 new polygons in addition to the 47 polygons mapped during the 2005 and 2006 reconnaissance surveys (SCL 2006). The sizes of many of the RTE plant populations known before the 2007 survey, some of which are element occurrences, were enlarged significantly.

Eleven RTE plant polygons mapped during the 2005/2006 reconnaissance surveys were outside of the study area for this study. Although they are present in the 2005/2006 survey area, two RTE plant species—bulb-bearing water-hemlock (*Cicuta bulbifera*) and marsh muhly (*Muhlenbergia glomerata*)—are completely outside of the 2007 study area boundary. The 2007 surveys did relocate 6 of the 12 pre-2005 occurrences recorded by the USFS or WNHP and not found during the 2005 and 2006 reconnaissance surveys. The 6 pre-2005 occurrences that were not found in 2005, 2006, or 2007 are designated as "not relocated" in Appendix 2.


Legend
Astragalus microcystis (ASMI)
Carex capillaris (CACA)
Carex flava (CAFL)
Carex krausei ssp. porsildiana (CAKR)
Cryptogramma stelleri (CRST)
Hierochloe odorata (HIOD)
Hypericum majus (HYMA)
Impatiens aurella (IMAU)
Muhlenbergia mexicana var. mexicana (MUME)
Ophioglossum pusillum (OPPU)
Sanicula marilandica (SAMA)
Sisyrinchium septentrionale (SISE)
Viola renifolia (VIRE)
Roads
Streams
Waterbodies
Study Area Boundary
Unpublished Work Copyright 2008 Seattle City Light
CANADA
UNITED STATES
Boundary Dam
Crescent Lake
Pewee Falls
Pewee Creek
Upper Lead King Lake
Lower Lead King Lake
Everett
Flume
Beaver
C2975
Ledbetter Lake
Middle Fork Flume Creek
South Fork Flume Creek
Oreille Creek
Threemile Cr.
Pend
Lime Lake
Lime Creek
Slate Creek
Slumber Creek
31
SEATTLE CITY LIGHT
BOUNDARY HYDROELECTRIC PROJECT
FERC PROJECT NO. 2144
Figure 5.2-1
General locations of RTE plant species found in the study area.
(Not including Dryas Drummondii and Thalictrum dasycarpum)
(Map 1 of 2)
Map Key
0 0.5
Miles
N
Map Version 08/12/08


Legend
Astragalus microcystis (ASMI)
Carex capillaris (CACA)
Carex flava (CAFL)
Carex krausei ssp. porsildiana (CAKR)
Cryptogramma stelleri (CRST)
Hierochloe odorata (HIOD)
Hypericum majus (HYMA)
Impatiens aurella (IMAU)
Muhlenbergia mexicana var. mexicana (MUME)
Ophioglossum pusillum (OPPU)
Sanicula marilandica (SAMA)
Sisyrinchium septentrionale (SISE)
Viola renifolia (VIRE)
Roads
Streams
Waterbodies
Study Area Boundary
Unpublished Work Copyright 2008 Seattle City Light
Flume Creek
Threemile Creek
South Fork Flume Creek
Oreille River
Pend Oreille
Lime Lake
Linton Creek
Metaline
Metaline Falls
Sullivan Creek
C9345
Pocahontas Creek
Sweet Creek
Lunch Creek
Lost Creek
Lost Lake
Wolf Creek
Wolf Lake
Sand Creek
31
Box Canyon Dam
SEATTLE CITY LIGHT
BOUNDARY HYDROELECTRIC PROJECT
FERC PROJECT NO. 2144
Figure 5.2-1
General locations of RTE plant species found in the study area.
(Not including Dryas Drummondii and Thalictrum dasycarpum)
(Map 2 of 2)
Map Key
0 0.5
Miles
N
Map Version 01/30/08


Legend
Dryas drummondii (DRDR)
Thalictrum dasycarpum (THDA)
Roads
Streams
Waterbodies
Study Area Boundary
Unpublished Work Copyright 2008 Seattle City Light
CANADA
UNITED STATES
Boundary Dam
Crescent Lake
Pewee Falls
Pewee Creek
Fence Creek
Lime Creek
Creek
Creek
31
Upper Lead King Lake
Lower Lead King Lake
Slumber Creek
Everett Creek
River
Slate Creek
Flume
Beaver
C2975
Ledbetter Lake
Middle Fork Flume Creek
Creek
Creek
Orville
Threemile Cr.
Pend
Lime Lake
South Fork Flume Creek
SEATTLE CITY LIGHT
BOUNDARY HYDROELECTRIC PROJECT
FERC PROJECT NO. 2144
Figure 5.2-2
General locations of RTE plant species Dryas drummondiiand Thalictrum dasycarpum found in the study area.
(Map 1 of 2)
Map Key
0
0.5
Miles
N
Map Version 01/30/08


Legend
Dryas drummondii (DRDR)
Thalictrum dasycarpum (THDA)
Roads
Streams
Waterbodies
Study Area Boundary
Unpublished Work Copyright 2008 Seattle City Light
Flume
Threemile
Creek
River
Creek
South Fork Flume Creek
Oreille
Lime Lake
Pend
C9345
Sullivan
Creek
Sweet
Linton
Creek
Metaline Falls
Metaline
Pocahontas
Creek
Lunch
Creek
Creek
Wolf Lake
Wolf
Creek
Lost Lake
Lost
Creek
31
Sand
Creek
Box Canyon Dam
SEATTLE CITY LIGHT
BOUNDARY HYDROELECTRIC PROJECT
FERC PROJECT NO. 2144
Figure 5.2-2
General locations of RTE plant species Dryas drummondii and Thalictrum dasycarpum found in the study area.
(Map 2 of 2)
Map Key
0
0.5
Miles
N
Map Version 01/30/08

Four new RTE plant species were located in the study area during the 2007 surveys: hair-like sedge (*Carex capillaris*), Canadian St. John's-wort (*Hypericum majus*), common northern sweetgrass (*Hierochloe odorata*), and adder's-tongue (*Ophioglossum pusillum*). The 2007 surveys also found northern blue-eyed grass (*Sisyrinchium septentrionale*) along the reservoir shoreline. Formerly, this species had only been observed outside of the 2007 study area.

The 2007 surveys also documented two species in the study area—Porsild's sedge (*Carex krausei* ssp. *porsildiana*) and wirestem muhly (*Muhlenbergia mexicana* var. *mexicana*)—that have been added to the WNHP rare plant list because of their probable rarity in the state (Arnett 2008a, 2008b). The study area population of Porsild's sedge represents the first documented occurrence of this species in Washington; the nearest known populations are in northeastern Canada. Herbarium collection data from Washington State University and the University of Washington suggest that there are few populations of wirestem muhly in the state; the localities from which these collections were made are very old and some of those populations may no longer exist. The study area supports a number of small subpopulations of this species.

There were no observations and no historical records of the federally-listed Ute ladies'-tresses (*Spiranthes diluvialis*), the only federally-listed species potentially occurring in or near the study area. A similar species, hooded ladies'-tresses (*Spiranthes romanzoffiana*), was located in the Boundary tailrace and in the Canyon Reach (Metaline Falls to downstream end of Z Canyon; PRM 26.8 to 18.0). It is a common species in the Pacific Northwest.

None of the target non-vascular RTE species (mosses and lichens) potentially occurring in the study area were observed during the 2007 field surveys. Only one of these species, naked kidney lichen (*Nephroma bellum*), has been documented near the Project. Suitable habitat for this species and many of the other nine non-vascular plants on the target list is potentially present in the study area.

The taxonomy, status, habitat requirements, and distribution of the 15 RTE plant species documented in the study area are discussed below. Most of the range and morphological information in this section is adapted from WNHP (2007) and the *Vascular Plants of the Pacific Northwest* (Hitchcock et al. 1955–1969).

5.2.1 Least Bladdery Milk-vetch (*Astragalus microcystis*)

Least bladdery milk-vetch is in the pea family and is a taprooted plant with a low branching root crown. The stems are prostrate to slightly decumbent with 9 to 15 hairy, gray-green leaflets. Large specimens tend to become low mounds of dark green foliage. The pinkish to purplish flowers develop into a sessile, oval, slightly inflated fruit that is up to one-half inch long.

Least bladdery milk-vetch is a regional endemic with a range restricted to southern British Columbia, northern Idaho, western Montana, Wyoming, and Washington. In Washington, it is known from 26 recent occurrences in the Columbia Basin, Okanogan Highlands, Olympic Peninsula, and the southwest Washington physiographic provinces in Jefferson, Stevens, Pend Oreille, Lincoln, and Clallam counties. Typical habitat for this State Sensitive species includes

gravelly to sandy areas, from riverbanks to open woods. Hitchcock and Cronquist (1973) was used to positively identify this species.

In the study area, 5 populations of least bladdery milk-vetch, comprising 17 subpopulations (polygons), were found ranging from PRM 17 to 34. Three of the populations were found along the reservoir upstream of Metaline Falls and were found on USFS, BLM, SCL, DNR, Pend Oreille Public Utility District No. 1, and private lands. The largest population extends 1.8 miles, is over 15 acres in size, and has several thousand plants. The least bladdery milk-vetch populations in the study area show a wide range of tolerances to different habitat conditions. Plants range from the upper portion of the littoral zone (elevation 1,989–1,994 feet NAVD 88 [1,985–1,990 feet NGVD 29]) to more than 100 feet above this level on dry eroding slopes and the tops of reservoir banks. Its typical substrate includes hardpacked cobble, gravel, sand, silt loam soils, and eroding slate. Plants in the littoral zone were completely submerged by water when water surface levels were high. This species was also observed on a site covered with a fill-gravel substrate near Box Canyon Dam, and in forest openings at several locations. All sites supporting least bladdery milk-vetch are characterized by sparse vegetative cover, so this species experiences little competition for light and space from other plants. Least bladdery milkvetch often grows on steep eroding substrates or in the littoral zone and apparently tolerates some natural disturbance processes like erosion and seasonal flooding.

Species associated with least bladdery milk-vetch populations in the study area include Atkinson's tickseed (*Coreopsis atkinsoniana*), white sage (*Artemisia ludoviciana*), common gaillardia (*Gaillardia aristida*), field mint (*Mentha arvensis*), common St. John's wort (*Hypericum perforatum*), and oxeye daisy (*Leucanthemum vulgare*).

5.2.2 Hair-like Sedge (*Carex capillaris*)

Hair-like sedge is a medium-sized sedge with clustered stems. The terminal spike has male flowers or may have a few female flowers at the tips, while the lateral spikes are female on long, slender, nodding peduncles. The lowermost inflorescence bract is long sheathing. The perigynia are elliptic to lance-ovate, tapering to a short beak. The achene is three-sided.

Hair-like sedge has a circumboreal range. In North America, it ranges across the boreal regions and extends south to northeastern Oregon, Nevada, Utah, New Mexico, Michigan, and New York. This State Sensitive species is only known from three other occurrences in Okanogan County. Typical habitat for this species includes stream banks, wet meadows, wet ledges, and marshy lakeshores. Hitchcock and Cronquist (1973) was used to positively identify this species. A specimen was also confirmed by J. Mastroguiseppe, a *Carex* expert (2007).

In the study area, a small population of hair-like sedge was found at a single location on USFS land in the Canyon Reach. The habitat for hair-like sedge was a palustrine emergent wetland, a seep-fed wet meadow just above the reservoir shoreline. The substrate was probably moist throughout the growing season. Plants were approximately 2 to 3 feet above full pool level (1,994 feet NAVD 88 [1,990 feet NGVD 29]) and not subject to seasonal flooding. Associated species are red-osier dogwood (*Cornus sericea*), western redcedar (*Thuja plicata*), russet buffaloberry (*Shepherdia canadensis*), wild sarsaparilla (*Aralia nudicaulis*), golden sedge (*Carex*

aurea), oxeye daisy, and Douglas spiraea (*Spiraea douglasii*). There is also some Canada thistle (*Cirsium arvense*) growing in the population.

5.2.3 Yellow Sedge (*Carex flava*)

Yellow sedge is typically less than 3 feet tall and has clustered stems with flat basal and stem leaves. The terminal spike has all male flowers or has a few female flowers at the tips. The lateral spikelets are sessile or have short stalks, and typically have all female flowers. The spikes of the inflorescence tend to be crowded with one or more subtending, sheathless bracts much longer than the inflorescence. The mature perigynia are yellowish with somewhat long-tapered, slightly recurved achenes arranged in short, prickly-looking spikes.

Yellow sedge ranges across the northern U.S. states and southern Canadian provinces. In Washington, this State Sensitive sedge is known from 35 occurrences in Pend Oreille, Stevens, Ferry, Lincoln, and Whatcom counties. Typical habitat includes wet meadows, forested wetlands, bogs, and shores of streams and lakes. Hitchcock and Cronquist (1973) and WNHP (2007) were used to positively identify this species.

Two populations of yellow sedge, comprising 18 subpopulations, were found in the study area on USFS, BLM, and SCL lands. One of the populations is between PRM 18 and 25 on the Boundary Reservoir downstream of Metaline Falls, and the second population is located along both sides of the Boundary tailrace. Subpopulations range from one plant to many hundreds. Typical habitat of yellow sedge in the study area includes wet meadows along the reservoir shoreline, seeps, and stream-fed wetlands in or just above the littoral zone. This wetland species tolerates moist-to-wet habitats, and many of the subpopulations are inundated at full pool (1,994 feet NAVD 88 [1,990 feet NGVD 29]). Substrates range from gravelly to rich in organic matter. Yellow sedge typically grows with a diverse assemblage of forbs and graminoids. Associated species are knotsheath sedge (*Carex retrorsa*), fowl bluegrass (*Poa palustris*), lakeshore sedge (*Carex lenticularis*), and fowl mannagrass (*Glyceria striata*). In the study area, it is often found in close proximity to a number of other RTE plant species. Weed cover is quite high at some yellow sedge sites and includes oxeye daisy, reed canarygrass, common St. John's-wort, narrowleaf plantain, and yellow iris.

5.2.4 Porsild's Sedge (*Carex krausei* ssp. *porsildiana*)

One small population of Porsild's sedge was located in the study area—the first documented occurrence in Washington State. This species has temporarily been added to the Review Group 2 list by the WNHP, and will be evaluated for inclusion on either the Threatened or Endangered lists during the next revision of the main list (WNHP 2008a). The known range of Porsild's sedge includes northeastern Canada, Greenland, and Iceland, so this occurrence represents a significant range extension of thousands of miles. Porsild's sedge is taxonomically very closely related to hair-like sedge, a Washington Sensitive species (Ball 2002). A single population of hair-like sedge was located on the reservoir approximately 3 miles away. The section of the genus *Carex* that contains these two species is in need of taxonomic revision, after which it is possible that Porsild's sedge may be combined with hair-like sedge into a single highly variable species. Some taxonomists consider the subspecies *porsildiana* to be taxonomically indistinct

from the species *Carex krausei* as a whole. Mastroguiseppe (2007) provided the identity of the Boundary Reservoir specimen.

The Porsild's sedge population was located on damp, steep limestone rubble at the base of a cliff at and just above full pool (1,994 feet NAVD 88 [1,990 feet NGVD 29]). This site is on BLM land and has a substrate that is probably moist most of the growing season. Associated species are California butterwort (*Pinguicula macroceras*), little green sedge (*Carex viridula*), western panicgrass (*Dichanthelium acuminatum* var. *fasciculatum*), early blue (*Viola adunca*), and mountain deathcamas (*Zigadenus elegans*). Although it is possible that there are additional Porsild's sedge populations in the vicinity, probably the most significant threat to this species in the study area is its very small population size and isolation from other populations.

5.2.5 Steller's Rock-brake (*Cryptogramma stelleri*)

Steller's rock-brake is a fern with slender creeping rhizomes with sparse, delicate, thin colorless scales. Leaves are lanceolate to ovate, with a pinnatifid to twice-pinnate compound arrangement of leaflets. The fertile and sterile leaves are usually erect and scattered along the rhizome. The thin, delicate sterile leaves have lanceolate to wedge-shaped leaflets. The fertile leaves have narrower leaflets with inrolled margins or false indusia. The thread-like petioles are dark brown at the base and more greenish distally.

Steller's rock-brake, a Washington Sensitive species, is found in two disconnected areas. In the west, it is found in interior Alaska, Yukon, British Columbia, and in scattered locations in the western United States. In the east, its range includes Wisconsin, southern Ontario and Quebec, the southeastern Canadian provinces, and New England. In Washington, it is known from eight occurrences in Pend Oreille, Chelan, Stevens, and Okanogan counties. The typical habitat for Steller's rock-brake is moist, shaded limestone cliffs and ledges, on moss mounds, or in cracks at middle and upper altitudes in the mountains. In the study area, Steller's rock-brake is most reliably identifiable from May until mid-June after which the leaves turn brown and die. Hitchcock and Cronquist (1973) and information from the WNHP (2007) were used to positively identify this species.

Four small populations of Steller's rock-brake were documented in the study area on USFS and SCL lands. Two historic occurrences were re-located on nearly vertical limestone cliffs in the downstream end of the Canyon Reach. Despite several dedicated surveys in past years, plants at these two occurrences had not been observed since they were documented in 1953, before Boundary Dam was built. A population of plants located in 2006 by the USFS botanist was re-located at Slate Creek. In addition, a small, new population was located near Boundary Dam. All of these populations are relatively small in size and in numbers of plants (3 to 23 plants). Individual plants are short-rhizomatous and may have few to many hundreds of leaves. Less vigorous plants consist mostly of sterile leaves and very few fertile leaves. Habitat in the study area was typical: plants were growing on moist, shaded limestone cliffs and ledges, on moss mounds, and in cracks. Associated species are Douglas-fir (*Pseudotsuga menziesii*), western redcedar, mallow ninebark (*Physocarpus malvaceus*), Lewis' mockorange (*Philadelphus lewisii*), shrubby penstemon (*Penstemon fruticosus*), brittle bladderfern (*Cystopteris fragilis*), and smooth cliffbrake (*Pellaea glabella* var. *simplex*). Plants were observed at and above full

pool (1,994 feet NAVD 88 [1,990 feet NGVD 29]), suggesting that this upland species may not tolerate inundation.

5.2.6 Yellow Mountain-avens (*Dryas drummondii*)

Yellow mountain-avens is a semi-evergreen prostrate woody shrub with stems that produce roots where they contact soil; this growth process often produces large mats. This species has nodding flowers with yellow, erect petals that are often stipitate glandular and somewhat hairy. The hairy, twisted styles attached to young achenes that expand at maturity into a characteristic fluffy, wind dispersal mechanism for the achene. The thickish, dark green leaves are roughly three-quarter inch in length. The top surface of the leaf is creased and glabrous or hairy while the underside is white-wooly. The leaf blades are widest above the middle with rounded tips and a wedge-shaped base.

A Washington Sensitive species, yellow mountain-avens ranges from Alaska south into Washington and northeastern Oregon, and eastward across the lower Canadian provinces to the St. Lawrence River. In Washington, this species is known from six occurrences in Pend Oreille, Snohomish, Stevens, Clallam, and Jefferson counties. Typical habitat includes crevices in steep, rocky, dry cliffs, and on limestone rock along rivers. Hitchcock and Cronquist (1973) was used to positively identify this species.

In the study area, 4 populations, comprising 38 subpopulations of yellow mountain-avens, were found extending from PRM 17 to 27. Some of the subpopulations were quite large, ranging to over 3,000 feet in length and over 13 acres in area. Combined, the 4 populations are estimated to include tens of thousands of plants and occur on USFS, BLM, DNR, SCL, and private lands. Yellow mountain-avens is primarily located on steep to vertical limestone cliffs abutting the reservoir from Metaline Falls downstream to Boundary Dam. Plants grow in limestone-derived soil and in cracks of limestone cliffs. This species is well adapted to the dry, exposed nature of this substrate. Plants of all size classes were noted. Density varied from single individuals and a few widely spaced plants to clusters of several hundred growing in relatively dense concentrations. Most populations were observed with binoculars from a boat, so it was sometimes difficult to distinguish individual plants, as they often grow quite close together. Associated species include western redcedar, Douglas-fir, harebell (*Campanula rotundifolia*), shrubby beardtongue (*Penstemon fruticosus*), Lewis' mockorange, roundleaf alumroot (*Heuchera cylindrica*), and kinnickinnick (*Arctostaphylos uva-ursi*). Weed species do not appear to be a threat to this species. Plants were observed just above the full pool level (1,994 feet NAVD 88 [1,990 feet NGVD 29]) to more than several hundred feet upslope, suggesting that they may not tolerate inundation.

5.2.7 Common Northern Sweetgrass (*Hierochloe odorata*)

Common northern sweetgrass is a perennial, rhizomatous species that often has purple-tinged leaf bases. The inflorescence is 5 to 10 centimeters long and open-pyramidal. The spikelets are 5 to 6 millimeters long and three-flowered. The bottom two florets are male and the terminal floret is bisexual. The two glumes are unequal in size, but are longer than the lemmas.

In North America, common northern sweetgrass ranges from Alaska to Labrador, south to Oregon, Nevada, Arizona, New Mexico, South Dakota, the Great Lakes region, and Pennsylvania. Although it was known from a number of historic localities throughout Washington, there are currently 14 occurrences scattered throughout the state. This species is included in Review Group 1, with more information needed about the degree of its rarity in the state. Typical common northern sweetgrass habitat includes moist slopes, meadows, and stream banks, from the foothills to subalpine elevations. Common northern sweetgrass is an important cultural plant for many Native Americans. Hitchcock and Cronquist (1973) was used to positively identify this species.

In the study area, a long, discontinuous population of common northern sweetgrass was found along the tailrace and another small population occurred north of Slate Creek. Both of these sites are on SCL land. It occurs in riparian habitat with upslope stream-fed seeps and in the littoral zone. It is associated with a diverse assemblage of forbs and graminoids. Common associated species include paper birch (*Betula papyrifera*), western redcedar, wooly sedge (*Carex pellita*), common self-heal (*Prunella vulgaris*), aster species (*Aster* spp.), and bentgrass species.

5.2.8 Canadian St. John's-wort (*Hypericum majus*)

Canadian St. John's-wort is an annual herbaceous species with upright stems and yellowish orange flowers about equal in length to the lanceolate sepals. The flowers have between 15 and 35 stamens. It flowers between July and September. Canadian St. John's-wort ranges from British Columbia east to Quebec, south through Pennsylvania, New Jersey, Illinois, Iowa, and Colorado. In Washington, it is known from 17 occurrences in Benton, King, Pend Oreille, Thurston, Whatcom, Franklin, and Skagit counties. Typical habitat for this state Sensitive species includes riparian habitats, ponds, lakesides, and other low, wet places. Hitchcock and Cronquist (1973) was used to positively identify this species.

In the study area, a population comprising five subpopulations of Canadian St. John's-wort was found at the north end of the reservoir on private and DNR lands. The subpopulations are not very vigorous, with an average area of 10 by 20 feet and numbers ranging from 10 to 100 plants. This species is an annual species and thus population numbers and locations may vary from year to year. Plants are often small and difficult to see in dense vegetation. In the study area, plants were typically found in the lower vegetated portion of the littoral zone where there is significantly less weed coverage, especially reed canarygrass (*Phalaris arundinacea*). Plants were found growing in silty substrates, in nearly flat slough areas, and with a diverse assemblage of forbs and graminoids. Associated species include fringed loosestrife (*Lysimachia ciliata*), common sneezeweed (*Helenium autumnale*), Canada thistle, small-flowered forget-me-not (*Myosotis laxa*), field mint, sedge species (*Carex* spp.), witchgrass (*Panicum capillare*), and slender rush (*Juncus tenuis*). During the survey, plants were observed in locations that were exposed and moist, as well as sites that were completely inundated with water.

5.2.9 Orange Balsam (*Impatiens aurella*)

Orange balsam is a glabrous annual forb with slightly yellowish-green, brittle, hollow stems. The species has a weak, often shallow root system. Leaves have an opposite arrangement on young plants but become alternate on older plants. The characteristic leaf shape is ovate-elliptic

with several coarse serrations along the margin. The fruits are capsules that spring open to forcibly eject the ripe seeds. The pale yellow to orange, spurred flowers arise from the leaf axils and are often in pairs.

The range of orange balsam includes eastern Washington, northern Idaho, Oregon, southeast British Columbia, and western Montana. It is known from 23 occurrences in 10 counties throughout Washington. Orange balsam was on the Review Group 2 list until recently. The taxonomic status of Review Group 2 species is under review by the WNHP. It is currently included in Review Group 1 to collect more information about the degree of its rarity in the state before a status can be assigned. Zika (2006) and Hitchcock and Cronquist (1973) were used to positively identify this species.

In the study area, eight populations of orange balsam were located along Boundary Reservoir and the tailrace. It was found on USFS, BLM, SCL, DNR, and private lands. This species is an annual, so location and numbers of plants may vary from year to year. A majority of plants at some of the populations did not develop enough to flower or fruit, suggesting that suboptimal growing conditions exist locally. The habitat includes moist woods, moist herbaceous meadows, riparian habitats, spring-fed seeps, and other low, wet places. The largest and most vigorous populations are located in palustrine forested wetlands and have over a thousand plants. These forested wetlands are composed primarily of deciduous tree species such as black cottonwood (*Populus balsamifera* var. *trichocarpa*) and Sitka alder (*Alnus viridis* spp. *sinuata*). Other commonly associated species are western redcedar, red-osier dogwood, willow species (*Salix* spp.), field mint, horsetail (*Equisetum* spp.), and giant goldenrod (*Solidago gigantea*).

5.2.10 Wirestem Muhly (*Muhlenbergia mexicana* var. *mexicana*)

Wirestem muhly is a perennial, rhizomatous grass. It has single-flowered spikelets with glumes that are approximately the same length as the lemma. It can be differentiated from marsh muhly, which was documented in the Project vicinity during the reconnaissance surveys, by the relative size of its glumes and lemmas and its habitat. Herbarium collection data from Washington State University and the University of Washington suggest that there are few populations of wirestem muhly in the state and that the localities from which these collections were made are very old; some of those populations may no longer be in existence.

Wirestem muhly has been added to the WNHP Review Group 1 list and will be evaluated for inclusion onto either the Sensitive, Threatened, or Endangered lists during the next revision of the main list in 2009 (Arnett 2008b). This species occurs in most of the U.S. except for the southeastern states. Its typical habitat includes mesic to wet areas such as moist prairies, woodlands, stream banks, roadsides, ditch banks, lake margins, swamps, bogs, and hot springs (Peterson 2003). Hitchcock and Cronquist (1973) and Peterson (2003) were used to positively identify this species. The identity of the wirestem muhly specimen was confirmed by P. Zika (2007).

In the study area, 24 small subpopulations of wirestem muhly were found in the littoral zone along the reservoir margin on USFS, BLM, SCL, DNR, and private lands. Subpopulations are typically narrow, linear, and discontinuous; some of them are several hundred feet long. Habitats include moist weedy meadows, seeps, and cracks of rocks. Many of the subpopulations

are at least partially inundated at full pool (1,994 feet NAVD 88 [1,990 feet NGVD 29]). Substrates include organic matter, limestone rock, and gravel. Wirestem muhly typically grows with a diverse assemblage of forbs and graminoids including Sitka alder, white sweetclover (*Melilotus albus*), common tansy (*Tanacetum vulgare*), narrowleaf plantain (*Plantago lanceolata*), fringed loosestrife, wooly sedge (*Carex pellita*), bentgrass, and slender rush.

5.2.11 Adder's-tongue (*Ophioglossum pusillum*)

Adder's-tongue is an unusual fern species with an upright fertile spike and a single undivided basal frond. It is identifiable from May through September but can be difficult to see growing in dense vegetation. It is a circumboreal species known from Alaska to the east coast, and many states and Canadian provinces in between. In Washington, adder's-tongue is included on the Threatened list and is known from 15 occurrences scattered throughout 8 counties. Typical habitat includes moist meadows, woods, boggy areas, pastures, old fields, roadside ditches, and floodplain woods in seasonally wet, rather acid soil. Hitchcock and Cronquist (1973) and WNHP (2007) were used to positively identify this species. In Hitchcock and Cronquist (1973), the synonym for this species is *Ophioglossum vulgatum* var. *pseudopodum*.

In the study area, two small adder's-tongue populations, one with 50 plants, the other with 150, were located along the southern portion of the reservoir downstream of Metaline Falls on SCL and BLM lands. Both populations were found in the vicinity of several other RTE plant species. The populations are located in the upper portion of the littoral zone in moist, weedy meadows at the reservoir edge near the high water surface levels. It appeared as though at least the bases of the plants were inundated at higher reservoir levels. Neither location appears to be associated with upslope seeps or hydrology. Associated species are fringed loosestrife, bentgrass species, sedge species, white sweetclover, common St. John's-wort, oxeye daisy, narrowleaf plantain, scouring rush, and common tansy; most of these plant associates are weeds.

5.2.12 Black Snake-root (*Sanicula marilandica*)

Black snake-root is an herbaceous perennial with fibrous roots and a short, simple root crown. There is a cluster of distinctive basal leaves which have long petioles and are palmately compound with 5 to 7 simple or lobed oblanceolate leaflets. The flowering stems are solitary and up to 5 feet in height. The cauline leaves are sessile, typically subtending the peduncles, and occur singly or in opposite pairs or whorls. The inflorescence is a compound umbel with umbelettes of round clusters of very tiny white-green flowers. The mericarp, or fruit, has long, recurved spines.

Black snake-root is distributed throughout Canada and south to Florida and New Mexico. In Washington, this species is known from 42 occurrences in the Eastern Cascades and Okanogan Highlands physiographic provinces, which include Stevens, Okanogan, Ferry, Spokane, and Pend Oreille counties. Typical habitat for this State Sensitive species is moist, low ground, such as meadows, riparian flood plains, moist woods, and marsh edges. Hitchcock and Cronquist (1973) was used to positively identify this species.

In the study area, eight populations of black snake-root were located in the reservoir downstream of Metaline Falls between PRM 16 and 23 on USFS, BLM, and SCL lands. Habitat for black

snake-root includes seep-fed wet meadows along the reservoir shoreline, and seeps and small streams in forested areas adjacent to the reservoir. At most of the sites, the substrate appears to be moist the entire growing season. Typical substrate is loamy soil with moss and duff layers. All but one of the populations are located at least several feet above the full pool level (1,994 feet NAVD 88 [1,990 feet NGVD 29]) and are presumably not affected by reservoir water-level fluctuations. Population size ranged from 1 to 200 plants. At most of the populations, approximately half of the plants were vegetative. Associated species include red-osier dogwood, bunchberry (*Cornus canadensis*), oxeye daisy, Douglas spiraea, and liverleaf wintergreen (*Pyrola asarifolia).*

5.2.13 Northern Blue-eyed Grass (*Sisyrinchium septentrionale*)

Northern blue-eyed grass is an herbaceous perennial species in the iris family. This species has a caespitose or clumped growth form. The leaves are very narrow, grass-like, glaucous, green, and more or less erect. The inflorescence is terminal and subtended by bracts that are very unequal in length. The flowers are blue-violet to white with a yellow center. The perianth parts are narrowly elliptic to oblanceolate and pointed at the tip.

Northern blue-eyed grass is a State Sensitive species and has been found from British Columbia east to Manitoba and south to northeastern Washington, northern Idaho, and Montana. In Washington, northern blue-eyed grass is known from 36 occurrences in Stevens, Okanogan, Ferry, and Pend Oreille counties. It occurs primarily in open wet meadows, adjacent to perennial streams and sometimes in forested wetland mosaics. Henderson (1976) was used to positively identify this species.

Two small populations of northern blue-eyed grass were located in the study area on BLM and SCL lands. None of the three subpopulations are vigorous, with a range of 20 to 40 plants. It was found growing in the upper littoral zone in small, moist, weedy meadows at the forested edge adjacent to the reservoir. Plants were just below to somewhat above the full pool level (1,994 feet NAVD 88 [1,990 feet NGVD 29]). Basal portions of some plants were inundated when water surface levels were high. The substrate is probably damp much of the growing season. Because this species is challenging to locate if not in bloom, it is possible other populations are in the vicinity. In the study area, plants bloom from May to mid-June. Associated species include bentgrass species, oxeye daisy, common St. John's-wort, narrowleaf plantain, wooly sedge, bluegrass species (*Poa* spp.), slender rush, and aster species.

5.2.14 Purple Meadowrue (*Thalictrum dasycarpum*)

Purple meadowrue is a rhizomatous, herbaceous perennial species that can grow to more than 8 feet tall. The somewhat leathery leaves are mainly cauline and typically three to four times ternately divided. The upper surface of the leaf is dark green, while the undersides are pale and often hairy. The species has male and female flowers arranged in panicles on separate plants. The calyces are greenish-white and petals are absent. Male flowers have many dangly orange-gold stamens, while female flowers have a persistent style and stigma that mature as an attachment to the achene. Terminal leaflets of purple meadowrue are typically dissected into three shallow lobes, which is a diagnostic characteristic that can be reliably used to distinguish it from columbine (*Aquilegia* spp.) and western meadowrue (*Thalictrum occidentalis*).

The range of purple meadowrue includes interior British Columbia, east to Saskatchewan, south to Texas, the Rocky Mountains, and the southwest U.S. to New Mexico and Arizona. This State Sensitive species is at the periphery of its range in Washington where it has been previously documented only in Pend Oreille County and only along the Boundary and Box Canyon reservoirs on the Pend Oreille River (13 occurrences). Its habitat includes deciduous riparian woods, damp thickets, swamps, and wet meadows, often adjacent to and/or within the floodplain. Park and Festerling (1997) and Hitchcock and Cronquist (1973) were used to positively identify this species.

Purple meadowrue was mapped throughout the entire study area from Box Canyon Dam north to the Canadian border. It grows in a linear distribution along the reservoir margin (up to 5,000 feet long) and in enormous patches (covering up to 47 acres at the BWP). Sixty subpopulations were mapped, which were combined into 7 large populations. It was found on USFS, BLM, DNR, SCL, and private lands and it is estimated that at least 20,000 plants are in the study area. The subpopulations range in size from a single plant to many thousands of plants. In the study area, the plant grows along the reservoir shoreline in mesic areas with shallow groundwater or in locations where seep runoff accumulates. Plants were found growing from the upper littoral zone in low gradient areas to over 30 feet above the full pool level (1,994 feet NAVD 88 [1,990 feet NGVD 29]) and were observed in dense shrubs and herbaceous vegetation, forest openings, seeps, adjacent roads, riprap, and out of cracks on limestone cliffs.

Purple meadowrue grows in plant communities that are predominantly native (as at the tailrace population) but it also competes well with aggressive non-native species like reed canarygrass and is sometimes the only native plant present in areas with dense reed canarygrass (as at some of the subpopulations in the reservoir upstream of Metaline Falls). Common associated species include Sitka alder, common snowberry (*Symphoricarpos albus*), red-osier dogwood, reed canarygrass, oxeye daisy, common St. John's wort, Canada thistle, and tansy ragwort. It appears that the ecological conditions associated with the Boundary Reservoir favor this species. In the study area, purple meadowrue occurs with populations of many of the other RTE plant species.

5.2.15 Kidney-leaved Violet (*Viola renifolia*)

Kidney-leaved violet is a perennial species with short ascending rootstocks without horizontal rhizomes or an apparent stem. The leaves are kidney-shaped and have hairs along the veins on the leaf undersides. The flower stalks are usually shorter than the leaves. The flowers are white.

Kidney-leaved violet is distributed from Newfoundland west to British Columbia and south to New York, Colorado, and Washington. In Washington, this species has been documented in 20 occurrences in Clallam, Stevens, Spokane, Ferry, and Pend Oreille counties. This State Sensitive species may be found from lowland coniferous forest to subalpine slopes. It is generally found in cool, moist, forested sites and sometimes along ditches and streams. Hitchcock and Cronquist (1973) and WNHP (2007) were used to positively identify this species.

In the study area, kidney-leaved violet was typically found in moist shady habitats in coniferous forests. Populations were typically associated with shallow groundwater or streams, and were growing on undulating mossy substrate. All populations were located at least several feet above

full pool level (1,994 feet NAVD 88 [1,990 feet NGVD 29]) and are presumably not affected by the reservoir. All populations were located along the reservoir downstream of Metaline Falls between PRM 17 and 21 and were on USFS and BLM lands. Population numbers ranged from 10 to over 500 plants. Associated species are western redcedar, western hemlock (*Tsuga heterophylla*), grand fir (*Abies grandis*), Sitka alder, twinflower (*Linnaea borealis*), bunchberry, common snowberry, false Solomon's-seal (*Maianthemum stellatum*), violet species (*Viola* spp.), and beadlily (*Clintonia uniflora*). Kidney-leaved violet is commonly found growing with other species of violet. Because the flowers bloom in May in the study area, identification was made with vegetative characteristics. No flowers were observed at any of the populations, but an average of 5 percent of the plants had fruit. Many plants had just two or three leaves.

5.3. Effects Assessment

The following discussion describes existing and potential Project effects (Section 5.3.1), non-Project-effects (Section 5.3.2), and a summary of overall effects for each RTE plant species (Section 5.3.3). Existing and potential effects for each RTE plant polygon is provided in the individual sighting forms (Appendices 3 and 4) and in the table in Appendix 6. Although a great deal of effort was made to interpret a wide variety of site conditions while in the field, existing and potential impacts to RTE plant populations were not always evident during a site visit; conclusions were drawn based on the conditions observed at the time of the surveys and represent the best efforts possible. Because the RTE plant inventory occurred during a single growing season, it is unknown whether overall population trends of RTE plants in the study area are increasing, decreasing, or remaining constant in relation to these impacts.

5.3.1 Project Effects

Project effects on RTE plant populations include those associated with 1) water surface level fluctuations, 2) weeds, 3) erosion resulting from water surface level fluctuations, 4) Project-related recreation, and 5) maintenance activities associated with the Project. Each of these effects is discussed below. Table 5.3-1 summarizes Project effects on RTE plant subpopulations.

Table 5.3-1. Summary of potential and existing Project effects on subpopulations of RTE plant species in the study area.

RTE Plant Species	Number of Subpop-ulations	Number of Subpopulations Affected				
		Water Surface Level Fluctuations	Weeds Est. % Cover[1] L 0-10% M 11-50% H 51-100%	Erosion (Erosion Groups 2 and 3)[2]	Recreation	Project Maintenance Activities
Least bladdery milk-vetch	17	2	4 L 12 M 1 H	3	0	0
Hair-like sedge	1	0	1 L	0	0	0
Yellow sedge	18	18	6 L 12 M-H	0	2	0
Porsild's sedge	1	1	1 L	0	0	0
Steller's rock-brake	11	0	11 L	0	0	0
Yellow mountain-avens	38	0	38 L	1	1	7
Common northern sweetgrass	3	3	2 L 1 H	0	1	0
Canadian St. John's-wort	5	5	5 M	0	0	0
Orange balsam	8	5	5 M 3 H	1	0	1
Wirestem muhly	24	24	24 M-H	3	8	0
Adder's-tongue	2	2	2 H	0	0	0
Black snake-root	10	1	7 L 3 M	0	0	4
Northern blue-eyed grass	3	3	3 H	0	1	0
Purple meadowrue	60	41	2 L 54 M-H 4 H	9	14	0
Kidney-leaved violet	5	0	4 L 1 M	1	2	1
Total	206	105 (51%)	77 L (37%) 25 M (12%) 90 M-H (44%) 14 H (7%)	18 (9%)	29 (14%)	13 (6%)

Notes:
1 Ocular estimates of percent (%) canopy cover of live foliage for plant species represent an effective way to quickly collect abundance information. Because each plant species or vegetation layer (trees, shrubs, forbs, graminoids, etc.) has its own % canopy cover, total percent cover typically exceeds 100%.
2 Refer to text in Section 5.3.1.3 for an explanation of Erosion Groups.

5.3.1.1. Water Surface Level Fluctuations

In the Project area, vegetation, including RTE plant species, is limited to the upper margin of the Project fluctuation zone, with daily inundations preventing establishment farther down into the zone. For plants that grow in the fluctuation zone along Boundary Reservoir, there is an elevation below which they cannot tolerate the depth, duration, or frequency of inundation. Some species are more tolerant of inundation than others and can therefore grow lower in the littoral zone. The plant species that grow in the lowest level of this zone are typically small annual species. Water surface level fluctuations also influence groundwater levels around the reservoir, which in turn can affect RTE plant species distribution.

Project operations typically cause water surface levels in the reservoir to fluctuate on a daily basis, generally between 5 and 10 feet. From Metaline Falls to Boundary Dam, the median surface water elevation for the June 15–September 15 growing season is 1,990 feet NAVD 88 (1,986 feet NGVD 29), with a range of 1,987–1,991 feet NAVD 88 (1,983–1,987 feet NGVD 29). From the Box Canyon Dam tailrace to Metaline Falls, the median surface water elevation during the growing season ranges between 1,991 and 1,993 feet NAVD 88 (1,987 and 1,989 feet NGVD 29).

Of the 206 RTE plant subpopulations located in the study area, 105 (51 percent) were located in the fluctuation zone. Ten RTE plant species were affected by fluctuating water levels: least bladdery milk-vetch, yellow sedge, Porsild's sedge, common northern sweetgrass, Canadian St. John's-wort, orange balsam, wirestem muhly, adder's-tongue, northern blue-eyed grass, and purple meadowrue. The presence and persistence of these species in this zone suggest that they are adapted to variable hydrological conditions (see Table 5.1-1), including those created by existing Project operations. Regardless, although some plants, especially annual species, might not be killed directly, prolonged inundation during critical flowering and fruiting times could pose a threat to the reproductive success of some individual plants during some years.

It is difficult to assess the potential RTE plant habitat that has been affected by Project-related water level fluctuations but it is likely that these fluctuations have some limiting effect on the distribution of RTE species.

5.3.1.2. Weeds

Competition with weedy plant species may pose the largest threat to RTE plant populations in the study area. Weed infestations commonly contribute to the degradation and destruction of RTE plant populations and native plant habitat (WSNWCB 2007). In 2005 and 2006, SCL surveyed and mapped noxious weed populations in the study area (SCL 2006) and found common St. John's-wort, yellow flag, common tansy, oxeye daisy, Canada thistle, reed canarygrass, lanceleaf plantain, and white sweetclover to be common in the fluctuation zone. Common upland noxious weed species include Dalmatian toadflax (*Linaria dalmatica* ssp. *dalmatica*), cheatgrass (*Bromus tectorum*), common tansy, common St. John's-wort, spotted knapweed (*Centaurea stoebe* ssp. *micranthos*), and meadow hawkweed (*Hieracium caespitosum*). Some of these weed species are located in multiple habitat types. Most of the widespread weed species in the study area are included on the Class B and Class C weed lists for Pend Oreille County by the Washington State Noxious Weed Control Board (2007). Of the

Class B noxious weeds present in the study area, only purple loosestrife has been designated for control in Pend Oreille County. Class B weeds are either absent from or limited in distribution in some portions of the state but are very abundant in others. The goals are to contain the plants where they are already widespread and prevent their spread into new areas. Class C weeds are non-native plants that are already widespread in Washington. Counties can choose to enforce control of Class C weeds or they can educate residents about controlling them. No Class C weeds have been chosen for enforced control in Pend Oreille County. Most of the noxious weeds that are widespread in the study area are also common and widespread in the general region.

Unregulated riparian areas are dynamic systems, typically supporting many weed species. Managed reservoir systems often have higher overall cover of weed species, perhaps in part because of the disturbance regime created by their daily water surface level fluctuations. Daily water surface level fluctuations associated with hydroelectric reservoirs often exceed the wet/dry cycle tolerance of native forbs, favoring the establishment of ruderal non-native weeds and deeper-rooted woody riparian vegetation (Hill et al. 1998). Water surface level fluctuations and erosion can affect RTE plant populations by creating disturbed areas readily colonized by weeds that compete with native plant species, including RTE plant species. Weeds are abundant along most of the reservoir shoreline in the upper margin of the water surface level fluctuation zone, but are especially prevalent in low gradient, sheltered areas with abundant fine sediment.

Because most RTE plant subpopulations in the study area have at least some weed species in the vicinity, the percent cover of weeds at each subpopulation was estimated to give a relative measure of the impact of weeds (Appendix 6). This information is summarized in Table 5.3-1. The categories used to estimate weed cover were: low cover (0–10 percent), medium cover (11–50 percent), and high cover (51–100 percent). A total of 37 percent of subpopulations in the study area had low weed cover, with the remainder having medium to high weed cover.

The most widespread weeds in the study area are subdominant to dominant in the moist forb- and graminoid-dominated meadows in the littoral zone, lacustrine emergent wetlands, and palustrine emergent wetlands along the reservoir shoreline. These habitats all occur within the upper margin of the fluctuation zone and support populations of 10 RTE plant species: least bladdery milk-vetch, yellow sedge, Porsild's sedge, common northern sweetgrass, Canadian St. John's-wort, orange balsam, wirestem muhly, adder's-tongue, northern blue-eyed grass, and purple meadowrue. Except for Porsild's sedge, all of these RTE plant species have medium to high cover of weeds in many or all of their subpopulations. Although the influence of existing Project operations on the establishment, persistence, and spread of weeds is unknown, and it is also unknown if RTE plant population sizes are increasing, decreasing, or remaining constant, the possibility exists that frequent water surface level fluctuations favor weed species to the detriment of RTE plant species in some locations. In general, sites with higher levels of weed cover provide less opportunity for the establishment and persistence of RTE plant populations.

In contrast, some RTE plant species in the study area tend to occur in areas with a relatively low cover of weeds, including Porsild's sedge, Steller's rock-brake, yellow mountain-avens, black snake-root, and kidney-leaved violet. None of these species are associated with the fluctuation zone (except for Porsild's sedge). They also favor substrates that are characterized by one or

more of the following factors: higher gradient, less fine sediment, lower overall disturbance levels, or substrates primarily comprising bedrock. One such habitat type is the steep, rocky cliffs in much of the Canyon Reach. In addition, some upland forest habitats and the seepy, riparian fringe along the tailrace north of Boundary Dam have relatively low cover of weeds. In general, RTE and native plant species are most vigorous in vegetation communities that have a relatively low cover of weed species.

Some of the largest weed infestations in the study area consist of dense, low diversity swards of reed canarygrass growing on sandy alluvial bars, islands, and terraces upstream of Metaline Falls. Some of these infestations are many acres in size (such as the BWP). Reed canarygrass is much less common in the lower reservoir and in the tailrace. Purple meadowrue is one of the few native species that persists in some of these dense stands of reed canarygrass.

During the 2005 and 2006 noxious weed surveys, 18 infestations of yellow iris were mapped along the reservoir margins within the study area (Dwerlkotte 2007). Yellow iris is a Class C noxious weed in Pend Oreille County. During the 2007 surveys, 69 infestations of yellow iris were mapped, indicating that this species may be rapidly expanding its density and range along the margins of Boundary Reservoir. Of the 58 yellow iris infestations downstream of Metaline Falls, 14 were on the west side of the tailrace north of Boundary Dam. Many of these yellow iris infestations were in the vicinity of RTE plant populations. Although individual clumps were found along the rocky reservoir shoreline, multiple rhizomatous patches were observed in low gradient coves and inlets with sandy and silty substrates (typically palustrine and lacustrine emergent wetlands). Suitable habitat for yellow iris is widespread along the reservoir. Currently, these infestations are small to medium-sized. In other areas in eastern Washington, yellow iris rhizomes spread to form dense stands in wetlands that often exclude native wetland species (WSNWCB 2007).

Although not common in the study area, purple loosestrife is the only noxious weed found in the vicinity of RTE plant populations that has been designated for control in Pend Oreille County. Some of the previously mapped infestations along the reservoir have been the focus of control efforts by Pend Oreille County weed control specialists (SCL 2006). Although current infestation levels are relatively low, suitable habitat for purple loosestrife is widespread along the reservoir.

In addition to weed infestations currently present in the study area, there is the ongoing possibility of the introduction of new species of weeds and new infestations of weed species already present into the study area. New infestations of weeds that find reservoir shoreline habitat favorable can often spread rapidly throughout a reservoir because of the contiguous nature of suitable habitat.

5.3.1.3. Erosion

Project-related erosion generally occurs just above the fluctuation zone in both the upper and lower reservoir and results in bank undercutting, raveling, and slumping of the shoreline substrate. Erosion occurs at different rates through time and directly affects plants by removing the substrate they are rooted in and eventually the plants themselves. The distribution of plants in the Upper Reservoir Reach (Box Canyon Dam downstream to Metaline Falls [PRM 34.5 to

PRM 26.8]) is defined by the seasonal high flow zone, which is located above the zone where Project-related erosion occurs. In the lower reservoir, vegetation (including RTE plants) more commonly occurs in the Project-related erosion zone. To evaluate the potential impacts of Project-related erosion on RTE plants in the study area, a map of erosion sites was overlain with a map of RTE plant polygons (SCL 2009b). Fifty-two RTE plant locations were identified within 36 erosion sites where erosion had the potential to affect RTE plants (Appendix 7). It should be noted that both erosion and RTE plants are often discontinuous within their respective polygons.

A site visit to the Project area with a geologist was made from July 21 to 23, 2008, to evaluate the impacts of erosion at each of the 52 erosion sites identified in the vicinity of RTE plant polygons. Erosion occurring within RTE plant polygons was categorized according to the type of erosion occurring at the site as shown in Table 5.3-2.

Table 5.3-2. Number of erosion/RTE plant polygon intersections by erosion group.

Erosion Group	Definition	Number of Erosion/RTE Plant Polygon Intersections
Group 0	Erosion does not occur in the RTE plant polygon.	19
Group 1	Non-Project erosion occurs within the RTE plant polygon.	12
Group 2	Project erosion without impacts to RTE plants at the population level.	19
Group 3	Project erosion with potential to adversely impact RTE plants at the population level.	2
	Total	**52**

Of the 52 potential erosion polygon/RTE plant polygon intersections, erosion was not occurring within 19 of the RTE plant polygons (Group 0). Twelve RTE plant polygons that overlapped erosion polygons were affected by non-Project-related erosion (Group 1); most of these polygons are located in the Upper Reservoir Reach. There were 19 erosion sites located in 16 RTE plant polygons that had Project-related erosion effects occurring within the polygon, but without apparent negative impacts to the RTE plant populations found there (Group 2). Finally, 2 polygons had Project-related erosion effects with the potential to adversely impact RTE plants at the population level (Group 3).

Of the 19 erosion sites (located within 16, or 8 percent, of RTE plant polygons) included in Group 2, 11 were purple meadowrue, 3 were wirestem muhly, and 3 were least bladdery milk-vetch. These species were often found growing in similar densities at erosion sites and in adjacent non-eroding areas. Purple meadowrue and wirestem muhly are rhizomatous species often closely associated with the upper portion of the fluctuation zone whether erosion (Project or non-Project) is present or not. Rhizomatous species such as these are often able to effectively expand into new habitat as it is made available. Least bladdery milk-vetch also favors habitats with natural disturbance such as erosion. In the study area, individual stems or plants of these species may be affected by erosion, but the overall population (and, in most cases, the subpopulation) does not appear to be at risk. At these sites, a determination was made while in

the field that it was not warranted to attempt to stabilize the erosion to protect individual plants because these species are adapted to habitats with some erosion disturbance. Purple meadowrue and least bladdery milk-vetch were among the most common and widespread RTE species within the Project area.

Two RTE plant polygons are included in Group 3 (1 percent of all polygons) in which there were significant negative impacts from Project-related erosion (in conjunction with recreation activities). A population of kidney-leaved violet and a subpopulation of yellow mountain-avens were in the vicinity of an established BLM campsite and occurred on an eroding bank edge adjacent to the reservoir. A more detailed description of this site can be found in Section 5.3.1.4.

5.3.1.4. Project-related Recreation

Project-related recreational activities such as fishing, swimming, boating, and use of established and dispersed campsites along the reservoir have the potential to impact RTE plant populations. The Study 21 Recreation Resource Study Final Report documented 5 developed recreation sites in the RTE plant study area (SCL 2009c). Three of these sites (SCL Boundary Tailrace Recreation Area, SCL Boundary Forebay Recreation Area, and Metaline Waterfront Park) had a total of 6 subpopulations of RTE plants in the general vicinity. In addition to the developed recreation sites, 16 dispersed recreation sites were located in the RTE plant study area (SCL 2009c). Although most of these sites received light recreational use, some received moderate use. Most of these sites were located in the lower reservoir, were day and overnight use sites with firepits, were accessible by water only, and were usually located somewhat inland of the shore. Of these 16 dispersed recreation sites, 13 had a total of 23 RTE plant subpopulations in the vicinity. Thus, a total of 29 RTE plant subpopulations (14 percent) occurred in the general vicinity of recreation sites in the study area. Generally, the impact of recreation on RTE plants at these sites appeared to be low either because most recreation use occurred on portions of the site that did not support RTE plant populations or because the recreation sites were large enough that the use was fairly diffuse (vs. being concentrated in a small area).

Most (72 percent) of the RTE plant subpopulations that occurred in the vicinity of these recreation sites were purple meadowrue and wirestem muhly. These are rhizomatous species often closely associated with the upper portion of the fluctuation zone in a linear distribution along the reservoir shoreline. Although some portions of a subpopulation might occasionally be trampled as recreationists fish or access their camps (a few trampled purple meadowrue individuals were observed), overall populations are not likely to be significantly impacted. Most camping activities tend to be upslope of the fluctuation zone where most RTE plant subpopulations occur.

The only site where recreational activities (in conjunction with Project-related erosion) appeared to be affecting more than a few individual RTE plants was at a BLM campsite on the lower reservoir shoreline where polygons of kidney-leaved violet and yellow mountain-avens were being affected. Although most of the kidney-leaved violet population is located in forested areas around the campsite, a small portion of the population occurs along the eroding edge of the reservoir. A small yellow mountain-avens subpopulation (8 by 10 feet) located in open forested habitat on the eroding bank adjacent to the reservoir is bisected by a 3-foot-wide trail (connecting the shore to the campsite). Recreational use of the area (i.e., trampling and trail use)

has accelerated Project-related erosion (bank undercutting in the fluctuation zone) at this site. In addition, a small trail following the shore away from the campsite bisects a small population of northern blue-eyed grass located approximately 250 feet away. It is possible that some individual plants could occasionally be trampled at this site.

5.3.1.5. Project Maintenance

Maintenance of Project-related facilities including roads, the transmission line ROW, and other ground-disturbing activities has the potential to affect RTE plants; however, negative impacts to RTE plant populations from Project maintenance were not observed. A total of 13 (6 percent) RTE plant subpopulations were located near Project facilities. Seven subpopulations of yellow mountain-avens were located near Boundary Dam facilities. Three of these were small subpopulations that have become established on disturbed cut banks or riprap adjacent to Project roads; the other 4 subpopulations were larger, growing on limestone cliffs around Boundary Dam. Individual plants in these subpopulations have the potential to be negatively affected by Project-related maintenance but there would be limited effects to overall yellow mountain-avens populations because this species is relatively widespread and common in the study area.

Maintenance of some Project facilities and roads could affect the hydrology of downslope seeps in the tailrace and associated RTE plant populations. Subpopulations of black snake-root and orange balsam are associated with seeps in the tailrace that occur downslope of roads used for the Project. In addition, a population of kidney-leaved violet is associated with a small creek that is downslope of a drainage ditch along the West-Side Access Road near the dam. Maintenance of the road or other alterations to the drainage ditch/creek could potentially adversely affect the kidney-leaved violet population.

5.3.2 Non-Project Effects

Potential and existing non-Project effects on RTE plant species include seasonal flooding, weeds, erosion, herbivory, disease, insect infestations, mining, grazing, upslope hydrologic disturbance, timber harvest, and non-Project road runoff. These are all briefly discussed in the following sections.

5.3.2.1. Seasonal High Flows

During the spring runoff period, natural flooding inundates portions of the reservoir shoreline and associated high veleocity flows can scour vegetation and prevent seedling establishment. The effects of seasonal high flows are most prominent in the upper reservoir. Due to the hydraulic control of Metaline Falls, this reach experiences less pronounced daily operational fluctuations than the lower reservoir and tailrace reaches, yet also experiences higher flood-related water surface elevations and flow velocities. The 1997 flood event resulted in the highest stage recording at USGS gage 12396500 since the completion of the Boundary Project. During this event, the peak water surface elevation at the USGS gage was recorded as approximately 2,020 feet NAVD 88 (2,016 feet NGVD 29) and the coincident Boundary forebay elevation was approximately 1,988 feet NAVD 88 (1,984 feet NGVD 29). Analysis conducted in support of Study 2 (2009d) estimated that the influence of the Boundary Project on water surface elevations in the Upper Reservoir Reach during this event ranged between 1.6 feet at the downstream end

of the reach to 1.1 feet at the upstream end of the reach. During these times, shoreline vegetation can experience prolonged inundation. The effects of seasonal flooding are negligible in the lower reservoir. However, the distribution of vegetation and RTE plant populations upstream of Metaline Falls is affected by seasonal flooding. Some RTE plant populations occur in the zone influenced by seasonal flooding, indicating their tolerance to periodic inundation and their ability to survive high velocity flows.

5.3.2.2. Weeds

Although it is likely that many weed infestations were introduced to the study area via non-Project vectors, the source of a weed introduction is often difficult to distinguish. Potential vectors of non-Project weed dispersal include seasonal flooding, non-Project erosion, transportation routes, mining, grazing, upslope hydrologic disturbance, timber harvest, and non-Project road runoff. Once weeds are introduced into the study area by non-Project sources, they may proliferate throughout suitable habitat; again, the source is difficult to distinguish. New weed infestations along reservoir shorelines are often able to spread rapidly because of the contiguous nature of suitable habitat.

5.3.2.3. Erosion

Of the 52 potential erosion/RTE plant polygon intersections mapped in the study area, it was determined that 12 of these polygons were affected by non-Project-related erosion (Appendix 7; also refer to Section 5.3.1.3). Most of these polygons were located upstream of Metaline Falls. The only RTE plant species in the study area affected by non-Project erosion were least bladdery milk-vetch and purple meadowrue. Purple meadowrue is a rhizomatous species often occurring in the upper portion of the fluctuation zone whether erosion (Project or non-Project) is present or not. Rhizomatous species are often able to effectively expand into new habitat as it is made available. Least bladdery milk-vetch also favors habitats with natural disturbance such as erosion. In the Project area, individual stems or plants of these species may be affected by non Project-related erosion, but overall populations do not appear to be at risk.

Non-Project erosion can also impact RTE plant populations in both the upper and lower reservoir as a result of precipitation, water flow upslope of the reservoir, and wind.

5.3.2.4. Herbivory, Disease, and Insect Infestations

The only RTE plant species on which herbivory was observed was purple meadowrue. Within three subpopulations, several plants were grazed by deer to within one or two feet of the ground. Disease or insect infestations were not observed to affect any RTE plants in the study area (however, disease and insect infestations may not be readily observable). The overall impact of herbivory, disease, and insect infestations in the study area appears to be very low.

5.3.2.5. Mining, Grazing, Timber Harvest, Road Runoff, and Upslope Hydrologic Disturbance

Mining, grazing, timber harvest, and road runoff have the potential to negatively affect RTE plant populations, but no such effects were observed. In addition, disturbances to hydrologic

features upslope from the study area (e.g., seeps, creeks, underground drainages, and groundwater) could potentially negatively affect a number of downslope populations of RTE plants. Potential disturbances to upslope hydrologic features could be associated with construction or maintenance of transportation routes, mining operations, non-Project transmission lines, land clearing, or other types of hydrologic alterations.

5.3.3 Project and Non-Project Effects to RTE Plant Populations by Species

Project and non-Project impacts (potential or existing) on each RTE plant species in the study area are summarized below. Although most RTE plant species are subject to a number of effects, some species are relatively unaffected. For information on impacts to individual RTE plant polygons, refer to Appendix 6, which contains a table listing Project and non-Project effects (existing and potential) for each RTE plant polygon.

5.3.3.1. Least Bladdery Milk-vetch

Least bladdery milk-vetch was found to be common and widespread in the study area, with 5 populations comprising 17 subpopulations. Some of the subpopulations were relatively large. Depending on the habitat, competition with both wetland and upland weed species such as common St. John's-wort, spotted knapweed, common tansy, Dalmatian toadflax, narrowleaf plantain, oxeye daisy, and annual brome species (*Bromus* spp.) may pose a threat to some subpopulations, although weeds did not seem to be prevalent in association with other subpopulations.

Non-Project-related erosion occurred at seven least bladdery milk-vetch subpopulations, all of which were in the Upper Reservoir Reach. Project-related erosion occurred within portions of three least bladdery milk-vetch subpopulations. Although some individual least bladdery milk-vetch plants may be affected by erosion (either Project- or non-Project-related), overall populations were not significantly affected. This species is adapted to dynamic riparian habitats where flood-related processes probably serve to reduce competition from other species.

5.3.3.2. Hair-like Sedge

There was a single population of hair-like sedge in the study area. It was growing in a seep on a graminoid-dominated bench several feet above the high water level of the reservoir. There was a small population of the weed Canada thistle in the population. Non-native species such as yellow iris and reed canarygrass occurred in similar habitats upstream of this site and could be a threat if they were to establish at this site. Although it is possible that there are more hair-like sedge populations in the vicinity, its relatively small population size and isolation from other populations make it potentially vulnerable.

5.3.3.3. Yellow Sedge

There were 2 populations of yellow sedge in the study area, comprising 18 subpopulations. Ten of these subpopulations were quite small, represented by one to three plants. These subpopulations may be at risk of disappearance due to the low number of individuals. The cover of weed species was relatively high at some yellow sedge sites and may have a negative effect

due to competition. Common weed species included oxeye daisy, reed canarygrass, common St. John's-wort, narrowleaf plantain, and yellow iris. Yellow sedge was not located in areas affected by erosion. Although yellow sedge subpopulations occurred in the vicinity of two low-use, dispersed recreation sites, they did not appear to be negatively affected by recreational activities occurring at these campsites (however, occasional trampling could occur).

5.3.3.4. Porsild's Sedge

There was a single, small population of Porsild's sedge in the study area. Competition with weedy species did not seem to be a threat to this population. In addition, its location was remote enough that it is probably well protected from human disturbance. Although it is possible that there are additional Porsild's sedge populations in the vicinity, probably the most significant threat to this species in the study area is its very small population size and isolation from other populations.

5.3.3.5. Steller's Rock-brake

There were 4 populations, comprising 11 subpopulations, of Steller's rock-brake in the study area. Although population sizes were generally small, most individuals of this rhizomatous species appeared to be fairly vigorous. Weed species, recreation, and erosion do not seem to be threats to Steller's rock-brake populations. No specific threats have been identified for populations of this species.

5.3.3.6. Yellow Mountain-avens

Yellow mountain-avens was common and widespread in the study area, with 4 populations comprising 38 subpopulations. Project operations and road maintenance have the potential to affect individuals within 7 subpopulations around Boundary Dam, but would not adversely affect the population. Competition from weed species does not seem to be a threat to yellow mountain-avens populations.

One small yellow mountain-avens subpopulation (8 by 10 feet) has been negatively affected by a combination of recreational activities and Project-related erosion at a BLM campsite in the lower reservoir. The erosion at this site was Project-related (bank undercutting in the fluctuation zone) and is accelerated by recreational use of the area (i.e., trampling and trails). Negative effects to this small subpopulation do not affect overall population numbers.

5.3.3.7. Common Northern Sweetgrass

There were two populations, comprising three subpopulations, of common northern sweetgrass in the study area. Competition with weeds may pose a threat to the small population in the Canyon Reach. Recreational activities have a low potential to affect a small subpopulation in the tailrace.

5.3.3.8. Canadian St. John's-wort

There was one population with five subpopulations of Canadian St. John's-wort in the study area. Plant numbers in the subpopulations of this annual species were relatively low (ranging from 10 to 100 plants), putting subpopulations at possible risk of local extirpation. Competition with weeds may pose a moderate risk to this species.

5.3.3.9. Orange Balsam

There were eight populations of this annual species in the study area. Although large orange balsam populations favor palustrine forested wetlands, smaller populations were found growing in a variety of other moist habitats in the study area. The tailrace population is potentially vulnerable to changes in upslope hydrology that could potentially occur in association with operation and maintenance of Forest Service Road 3165-200. Competition with weed species may pose a threat to some populations.

5.3.3.10. Wirestem Muhly

In the study area, there was one population of wirestem muhly, comprising 24 subpopulations. This species typically grows in linear rhizomatous patches less then 10 feet wide and sometimes several hundreds of feet long. In the study area, it was restricted to the fluctuation zone, where competition with weeds may be an issue in some areas.

Three wirestem muhly subpopulations occurred at sites with Project-related erosion but there appear to be no effects to these plants. Similar densities of wirestem muhly were observed growing at erosion sites and in adjacent non-eroding areas. It is a rhizomatous species closely associated with the upper portion of the fluctuation zone whether erosion (Project or non-Project) is present or not. Rhizomatous species such as this are often able to effectively expand into new habitat as it becomes available. Individual stems of this species may be affected by erosion (Project or non-Project-related), but because the species is adapted to habitats with erosion disturbance, the overall population is not significantly affected.

Seven subpopulations of wirestem muhly occurred in the vicinity of dispersed recreation sites. Although some portions of plants might occasionally be trampled by recreationists the overall population is not likely to be significantly affected. Most camping activities tend to be upslope of the fluctuation zone where this species occurs.

5.3.3.11. Adder's-tongue

There were two populations of adder's-tongue in the study area. Most of the plant associates at these populations were weeds; competition with these weeds is a significant threat. Also, both populations were in the immediate vicinity of abandoned roads (not related to the Project) and could be affected if road use were to be re-established. Although it is possible that additional adder's-tongue populations are in the vicinity, the small size and isolation increases the vulnerability of these known populations in the study area.

5.3.3.12. Black Snake-root

Black snake-root was observed in 8 populations comprising 10 subpopulations in the study area. Several subpopulations of black snake-root associated with seeps in the tailrace could be negatively affected if the hydrology were altered by maintenance of upslope roads and Project facilities. Competition with weeds poses a low to moderate threat to some populations of this species.

5.3.3.13. Northern Blue-eyed Grass

Two small populations comprising three subpopulations of northern blue-eyed grass occur in the study area. These occur in the littoral zone, which typically has a high cover of weeds. The number of plants at these sites tended to be low. One of the northern blue-eyed grass subpopulations was bisected by a small trail following the shoreline near a BLM campsite. It is possible that some individual plants could occasionally be trampled at this site.

5.3.3.14. Purple Meadowrue

Purple meadowrue was found to be common and widespread in the study area, with 7 populations comprising 60 subpopulations. Some subpopulations were quite large. Although several plants were observed to have been grazed by deer, herbivory does not seem to significantly affect this species.

Depending on the habitat, competition with both wetland and upland weed species such as common St. John's-wort, spotted knapweed, common tansy, Dalmatian toadflax, narrowleaf plantain, oxeye daisy, and reed canarygrass may pose a threat. Purple meadowrue often occupies habitat similar to the noxious weeds purple loosestrife and yellow iris.

Eleven purple meadowrue subpopulations occurred at sites with Project-related erosion, but did not appear to be significantly affected. Purple meadowrue is a vigorous, rhizomatous species often occurring in the upper portion of the fluctuation zone whether erosion (Project or non-Project) is present or not. Rhizomatous species such as this are often able to effectively expand into new habitat as it becomes available. Individual stems of this species may be affected by erosion but the overall population is not significantly affected. This species appears to be adapted to eroding habitats.

Subpopulations of purple meadowrue occurred in the vicinity of five developed and nine dispersed recreation sites. Recreationists may occasionally trample some plants but the overall population is not likely to be significantly affected. Most recreational activities tend to be upslope of the fluctuation zone where these plants typically grow.

Overall, it appears that the ecological conditions associated with Boundary Reservoir favor purple meadowrue.

5.3.3.15. Kidney-leaved Violet

There were five populations of kidney-leaved violet in the study area. Competition with weeds does not seem to be an issue for this species. One population of kidney-leaved violet was associated with a small creek downslope of a drainage ditch along the West-Side Access Road near Boundary Dam. Maintenance of the road or other alterations to the drainage ditch/creek could adversely affect kidney-leaved violet plants downslope, although such an effect was not observed.

A portion of one population of kidney-leaved violet has been negatively affected by a combination of recreational activities and Project-related erosion at a BLM campsite in the lower reservoir. Although most of the population was found in forested areas around the campsite, a small portion of the population was located at the eroding edge of the reservoir resulting in occasional negative effects on individual plants.

6 CONCLUSIONS

6.1. Summary

The RTE plant survey mapped and documented 206 polygons or subpopulations, which were combined into 53 populations of 15 different vascular RTE plant species (Figures 5.2-1 and 5.2-2). Multiple populations of RTE plants were located on lands with the following ownership designations: BLM, USFS, SCL, DNR, and private lands. In comparison with other RTE plant surveys of similarly sized areas, the Boundary study area has a relatively large number of both RTE species and subpopulations. Several factors present in the study area contribute to this including the relatively low levels of disturbance, overall habitat diversity, and the presence of specialized substrates such as limestone. In addition, the area is part of the inland temperate rain forest, and a number of plant species in the area are at the edge of their range.

Results of the 2007 survey suggest that four RTE plant species—yellow mountain-avens, least bladdery milk-vetch, orange balsam, and purple meadowrue—are locally abundant in the study area. Yellow mountain-avens is a predominant component of the vegetation growing on the limestone rock faces and cliffs along the lower reservoir. Similarly, least bladdery milk-vetch is relatively common on cobble bars, islands, and steep eroding slopes. Enormous populations of purple meadowrue were observed in a variety of habitats throughout the study area, and several large populations of orange balsam were observed in palustrine forested wetlands. These species may prove to be more common and less endangered in the state than previously believed.

In contrast, RTE species such as hair-like sedge, Porsild's sedge, adder's-tongue, northern blue-eyed grass, and Steller's rock-brake are relatively rare in the study area, with either few populations and/or populations with small numbers of plants. Some of these RTE plant species are similarly rare in the region. It is often difficult to identify the environmental factors contributing to the relative rarity or abundance of plant species.

Populations of 10 RTE plant species grow in the littoral, palustrine, and lacustrine wetland habitats along the reservoir where frequent Project-controlled fluctuating water surface levels

alternately expose and inundate the substrate and vegetation. RTE plant species that grow along the reservoir shoreline in the fluctuation zone are species most likely to be affected by potential Project- and non-Project-related effects such as water surface level fluctuations, erosion, competition from weeds, and recreation. These species often grow in close proximity to each other and include yellow sedge, northern blue-eyed grass, common northern sweetgrass, adder's-tongue, Canadian St. John's-wort, wirestem muhly, Porsild's sedge, orange balsam, least bladdery milk-vetch, and purple meadowrue. Alternatively, RTE plant populations found on steep dry limestone cliffs, such as Steller's rock-brake and yellow mountain-avens, are not subjected to many Project or non-Project-related threats, such as erosion, weeds, and recreation.

6.2. Conclusions

The following types of Project-related effects to RTE plants in the study area were evaluated: water surface level fluctuations, weeds, erosion, recreation, and Project maintenance activities. Non-Project impacts that were evaluated include seasonal flooding, weeds, erosion, herbivory, disease, insect infestations, mining, grazing, upslope hydrologic disturbance, timber harvest, and road runoff. The findings are summarized below:

- Project-related water surface level fluctuations affect 10 RTE plant species, which represent approximately half of all RTE plant polygons located in the study area. The presence and persistence of these species in this zone, however, suggest that they are adapted to variable hydrological conditions, including those created by existing Project operations.

- The most significant potential impact to RTE plant populations in the study area appears to be from competition with **weeds**, especially in the fluctuation zone, where many populations of RTE plants occur. Although the influence of existing Project operations on the establishment, persistence, and spread of weeds is unknown, as is whether RTE plant population sizes are increasing, decreasing, or remaining constant, the possibility exists that water surface level fluctuations favor weed species to the detriment of RTE plant species at some locations. Most of the weeds that are widespread in the study area are also common and widespread in the general region. Although most of these weeds are included on the Class B and Class C weed lists for Washington, purple loosestrife is the only weed designated for control in Pend Oreille County. Alternatively, some RTE plant species in the study area have habitats with relatively low weed cover.

- Of 30 RTE plant polygons with **erosion** occurring within them, 16 included Project-related erosion, but with no RTE plant population effects. Two polygons included Project-related erosion with the potential to adversely affect RTE plants populations. Thus, the combined effect of Project-related erosion on RTE plant populations in the Project area is relatively low.

- The overall effect of **recreational** activities on RTE plant populations in the study area is low. A total of 29 subpopulations are in the vicinity of recreation sites, but the

effect of recreation on RTE plants at these sites appears to be low. Most recreation use occurs in areas that do not support RTE plant populations or recreation sites are large enough that the use is fairly diffuse.

- The overall effect of Project **maintenance** on RTE plant populations is relatively low because few RTE plant populations are located near Project facilities. Although Project maintenance could potentially affect subpopulations of several nearby RTE plant polygons or the hydrologic features upon which some of them are dependent, no such effect was observed.

- **Seasonal flooding** (a non-Project effect) affects the distribution of RTE plant populations but the presence of these populations in such areas suggests that the species are tolerant of some level of seasonal flooding. The effect of seasonal flooding on RTE plant populations appears to be low.

- Although it is likely that many **weed** infestations were introduced to the study area via **non-Project** vectors, the source of a weed introduction is usually difficult to ascertain. Once weeds have been introduced, they may proliferate throughout the Project area in suitable habitat as a result of either Project- or non-Project-related processes. Competition with weeds is a significant potential threat to RTE plant populations in the study area.

- Of 30 RTE plant polygons with erosion occurring within them, 12 RTE were associated with **non-Project-related erosion**. This erosion does not appear to negatively affect RTE plant populations.

- The combined impact **of herbivory, disease, and insect infestations** (non-Project effects) in the study area appears to be very low.

- Negative effects to RTE plant populations in the study area from non-Project actions such as **mining, grazing, timber harvest, road runoff, and upslope hydrologic disturbance** were not observed.

The overall effect of Project and non-Project actions on RTE plant populations in the study area is relatively low considering the size of the area, and the large number of RTE plant species and subpopulations found within it.

7 VARIANCES FROM FERC-APPROVED STUDY PLAN AND PROPOSED MODIFICATIONS

No deviations from the FERC-approved RSP (SCL 2007) were made.

In the course of conducting fieldwork for this study in 2007, the need to conduct limited additional work in 2008 was identified. This work included more detailed analysis of the

following potential impacts to RTE plant populations: recreation, erosion, and Project maintenance and operations.

8 REFERENCES

Arnett, Joe. 2008a. E-mail from Joe Arnett, WNHP botanist, to K. Beck, Beck Botanical Services, regarding *Carex krausei* ssp. *porsildiana* status. January 10, 2008.

Arnett, Joe. 2008b. E-mail from Joe Arnett, WNHP botanist, to K. Beck, Beck Botanical Services, regarding Muhlenbergia mexicana var. mexicana status. January 11, 2008.

Ball, P.W. 2002. Carex. In: Flora of North America North of Mexico. Vol. 23, pp. 425-4777. Flora of North America Committee, eds. 1993+. New York and Oxford. 12+ vols.

BLM (Bureau of Land Management). 2005. Oregon/Washington BLM Special Status Species List. March. (Not available online as of September 2007.)

Crins, W.J. 2002. Carex. In: *Flora of North America North of Mexico*. Vol. 23, pp. 523-527. Flora of North America Editorial Committee, eds. 1993+. New York and Oxford. 12+ vols.

Dwerlkotte, R. 2007. Personal communication between R. Dwerlkotte, EDAW, and K. Beck, Beck Botanical Services, concerning yellow iris distribution on Boundary Reservoir. April 2007.

Henderson, D.M. 1976. A biosystematic study of Pacific Northwestern blue-eyed grasses (Sisyrinchium, Iridaceae). *Brittonia* 28: 149-176.

Hill, N.M., P.A. Keddy, and I.C. Wisheu. 1998. A hydrological model for predicting the effects of dams on shoreline vegetation of lakes and reservoirs. *Environmental Management* 22:723-736.

Hitchcock, C.L., A. Cronquist, M. Ownbey, and J.W. Thompson. 1955–1969. *Vascular Plants of the Pacific Northwest.* Parts 1–5. University of Washington Press. Seattle and London.

Hitchcock, C.L., and A. Cronquist. 1973. *Flora of the Pacific Northwest*. University of Washington Press. Seattle.

Mastroguiseppe, J. 2007. E-mail from J. Mastroguiseppe, WSU botanist, to K. Beck, Beck Botanical Services, with Carex krausei ssp. porsildiana and Carex capillaris confirmations. October 11, 2007.

NatureServe. 2004. The Habitat-Based Strategy for Delimiting Plant Element Occurrences: Guidance from the 2004 Working Group. Available online at: www.natureserve.org/library/deliminting_plant_eos_Oct_2004.pdf.

Nelson, J.R. 1985. Rare plant surveys: techniques for impact assessment. *Natural Areas Journal* 5(3):18-30.

Park, M.M., and D. Festerling. 1997. Thalictrum. In: *Flora of North America North of Mexico*. Vol. 3, pp. 258–268. Flora of North America Editorial Committee, eds. 1993+. 12+ vols. New York and Oxford.

Peterson, P.M. 2003. Muhlenbergia. In: *Flora of North America North of Mexico*. Vol. 25, pp. 145–200. Flora of North America Editorial Committee, eds. 1993+. 12+ Vols. New York and Oxford.

SCL (Seattle City Light). 2006. Pre-Application Document for the Boundary Hydroelectric Project (FERC No. 2144). Seattle, Washington. May 2006. Available online at: http://www.seattle.gov/light/news/issues/bndryRelic/br_document.asp.

SCL. 2007. Revised Study Plan for the Boundary Hydroelectric Project (FERC No. 2144). Seattle, Washington. February 2007. Available online at: http://www.seattle.gov/light/news/issues/bndryRelic/br_document.asp.

SCL. 2009a.. Study 22 – Land and Roads Study Revised Final Report for the Boundary Hydroelectric Project (FERC No. 2144). Prepared by Tetra Tech. March 2009.

SCL. 2009b. Study 1 – Erosion Study Final Report for the Boundary Hydroelectric Project (FERC No. 2144). Prepared by Watershed GeoDynamics and Tetra Tech. March 2009.

SCL. 2009c. Study 21 – Recreation Resource Study Final Report for the Boundary Hydroelectric Project (FERC No. 2144). Prepared by Tetra Tech. March 2009.

SCL. 2009d. Study 2 – Analysis of Peak Flood Flow Condition above Metaline Falls Final Report for the Boundary Hydroelectric Project (FERC No. 2144). Prepared by Tetra Tech. March 2009.

USFS (U.S. Forest Service). 2004. Region 6 Sensitive Species List. Portland, Oregon. July.

USFS. 2005a. Threatened, Endangered, and Sensitive Plants Survey Field Guide. USDA Forest Service. Rangeland and Management Staff. Washington, D.C.

USFS. 2005b. Threatened, Endangered, and Sensitive Plants Element Occurrence Field Guide. USDA Forest Service. Rangeland and Management Staff. Washington, D.C.

WNHP (Washington Natural Heritage Program). 1997-2003. Field Guide to Selected Rare Plants of Washington. Washington Department of Natural Resources. Olympia, Washington.

WNHP. 2007. Washington Rare Plant Species with Ranks. Accessed September 2007. Available online at http://www.dnr.wa.gov/nhp/refdesk/lists/plantrnk.html.

WSNWCB (Washington State Noxious Weed Control Board). 2007. Web site accessed October 2007. Available online at http://www.nwcb.wa.gov/.

Zika, P. 2006. Impatiens pacifica (Balsaminaceae), a new hybrid jewelweed from the Pacific Northwest Coast of North America. *Novon* 16: 443–448.

Zika, P. 2007. E-mail from P. Zika, botanist, to K. Beck, Beck Botanical Services, with Muhlenbergia mexicana var. mexicana confirmation. October 2, 2007.

This page intentionally left blank.

Appendix 1: Complete List of Vascular Plant Species Observed in the Boundary Hydroelectric Project Study Area, 2007

Table A.1-1. Complete list of vascular plant species observed in the Boundary Hydroelectric Project study area, 2007.

Taxon	Non-native / Washington Noxious Weed Status[1]	Washington Rare Plant State Status[2]
Abies grandis		
Acer douglasii		
Acer macrophyllum		
Acer negundo	x	
Achillea millefolium		
Actaea rubra		
Adenocaulon bicolor		
Agropyron cristatum	x	
Agropyron repens	x	
Agropyron smithii		
Agropyron spp.		
Agrostis capillaris	x	
Agrostis exarata		
Agrostis gigantea	x	
Agrostis scabra		
Agrostis spp.		
Agrostis stolonifera		
Alisma plantago-aquatica		
Allium cernuum		
Allium schoenoprasum		
Alnus incana spp. tenuifolia		
Alnus viridis spp. sinuata		
Alyssum alyssoides	x	
Amaranthus powellii		
Amelanchier alnifolia		
Anaphalis margaritacea		
Anemone multifida var. multifida		
Angelica arguta		
Antennaria racemosa		
Antennaria rosea		
Antennaria spp.		
Anthriscus scandicina	x	
Apocynum androsaemifolium		
Apocynum cannabinum		
Apocynum medium		
Aptera interrupta	x	
Arabidopsis thaliana	x	
Arabis glabra	x	
Arabis holboelii		
Aralia nudicaulis		
Arctium minus	x	
Arctostaphylos uva-ursi		
Arenaria serpyllifolia	x	
Arnica latifolia		
Arnica spp.		
Arrhenatherum elatius	x	
Artemisia douglasiana		
Artemisia lindleyana		
Artemisia ludoviciana		
Artemisia ludoviciana var. incompta		
Artemisia spp.		
Asarum caudatum		
Asparagus officinalis	x	
Asplenium trichomanes -ramosum (viride)		
Aster conspicuus		
Aster eatonii		
Aster foliaceus		
Aster hesperium		
Aster laevis		
Aster modestus		
Aster occidentalis		
Aster spp.		
Astragalus canadensis		
Astragalus microcystis		S
Astragalus robbinsii		
Athyrium filix-femina		
Beckmannia syzigachne		
Berberis aquifolium		
Berberis nervosa		
Berberis repens		
Betula papyrifera		
Bidens cernua		
Bidens cf. tripartita		
Bidens spp.		
Botrychium multifidum		

Table A.1-1, continued...

Taxon	Non-native / Washington Noxious Weed Status[1]	Washington Rare Plant State Status[2]
Botrychium virginianum		
Bromus ciliatus		
Bromus inermis	x	
Bromus japonicus	x	
Bromus mollis	x	
Bromus secalinus	x	
Bromus spp.		
Bromus tectorum	x	
Bromus vulgaris		
Calamagrostis canadensis		
Calamagrostis rubescens		
Callitriche verna		
Calypso bulbosa		
Campanula rotundifolia		
Cardamine pensylvanica		
Carex amplifolia		
Carex aperta		
Carex aquatilis		
Carex athrostachya		
Carex aurea		
Carex bebbii		
Carex brevior		
Carex capillaris		S
Carex cusickii		
Carex deweyana		
Carex disperma		
Carex flava		S
Carex geyeri		
Carex interior		
Carex krausei ssp. porsildiana		R2
Carex laeviculmis		
Carex lenticularis		
Carex leptalea		
Carex pachystachya		
Carex pellita		
Carex retrorsa		
Carex rossii		
Carex sitchensis		

Taxon	Non-native / Washington Noxious Weed Status[1]	Washington Rare Plant State Status[2]
Carex spp.		
Carex stipata		
Carex utriculata		
Carex vesicaria		
Carex viridula		
Carex vulpinoidea		
Castilleja hispida		
Castilleja miniata		
Ceanothus sanguineus		
Ceanothus velutinus		
Centaurea (biebersteinii) stoebe var. micranthos	B	
Ceratophyllum demersum		
Chamaesyce serpyllifolia		
Chenopodium album	x	
Chimaphila menziesii		
Chimaphila umbellata		
Chrysopis villosa		
Cicuta douglasii		
Cinna latifolia		
Cirsium arvense	C	
Cirsium undulatum		
Cirsium vulgare	C	
Clarkia pulchella		
Clematis columbiana		
Clinopodium douglasii		
Clintonia uniflora		
Collinsia parviflora		
Collomia grandiflora		
Collomia linearis		
Convolvulus arvensis	x	
Convolvulus spp.	x	
Conyza canadensis		
Corallorhiza maculata		
Coreopsis atkinsoniana		
Cornus canadensis		
Cornus sericea		
Corylus cornuta		
Crassula aquatica		
Crataegus columbiana		
Crataegus douglasii		

Table A.1-1, continued...

Taxon	Non-native / Washington Noxious Weed Status[1]	Washington Rare Plant State Status[2]
Crepis atribarba spp. atribarba		
Crepis atribarba spp. originalis		
Crepis spp.		
Cryptantha affinis		
Cryptogramma acrostichoides		
Cryptogramma stelleri		S
Cynoglossum offinale	B	
Cystopteris fragilis		
Dactylis glomerata	x	
Danthonia spicata		
Daucus carota	B	
Delphineum cf. nuttallianum		
Deschampsia caespitosa		
Dianthus armeria	x	
Dichanthelium acuminatum var. fasciculatum		
Dipsacus sylvester	x	
Disporum hookeri		
Disporum trachycarpum		
Downingia elegans		
Draba nemorosa		
Dryas drummondii		S
Dryopteris cf arguta		
Dryopteris expansa		
Dryopteris spp.		
Drypoteris felix-mas		
Echinochloa crus-gali	x	
Eleocharis acicularis		
Eleocharis ovata		
Eleocharis palustris		
Elodea canadensis		
Elymus canadensis		
Elymus glaucus		
Elymus spp.		
Epilobium angustifolium		
Epilobium ciliatum		
Epilobium glandulosum		
Epilobium spp.		
Epilobium watsonii		
Equisetum arvense		
Equisetum fluviatile		
Equisetum hyemale		
Equisetum laevigatum		
Equisetum scirpoides		
Equisetum spp.		
Equisetum sylvaticum		
Equisetum variegatum		
Erigeron philadelphicus		
Erigeron spp.		
Erigeron strigosus	x	
Erysimum cheiranthoides		
Euphrasia officinalis	x	
Festuca arundinacea	x	
Festuca idahoensis		
Festuca occidentalis		
Festuca pratense	x	
Festuca spp.		
Festuca subulata		
Fragaria vesca		
Fragaria virginiana		
Gaillardia aristata		
Galium aparine		
Galium boreale		
Galium spp.		
Galium trifidum		
Galium triflorum		
Gaultheria ovatifolia		
Gayophytum diffusum		
Geocaulon lividum		
Geranium cf molle	x	
Geum allepicum		
Geum macrophyllum		
Glecoma hederacea	x	
Glyceria grandis		
Glyceria spp.		
Glyceria striata		
Glycyrrhiza lepidota		

Table A.1-1, continued...

Taxon	Non-native / Washington Noxious Weed Status[1]	Washington Rare Plant State Status[2]
Gnaphalium palustre		
Gnaphalium spp.		
Goodyera oblongifolia		
Gratiola neglecta		
Gymnocarpium dryopteris		
Helenium autumnale		
Heracleum lanatum		
Heuchera cylindrica		
Hieracium albiflorum		
Hieracium aurantiacum	B	
Hieracium caespitosum	B	
Hieracium cynoglossoides		
Hierochloe odorata		R1
Hippurus vulgaris		
Holodiscus discolor		
Hordeum geniculatum	x	
Hypericum formosum		
Hypericum majus		S
Hypericum perforatum	C	
Iliamna rivularis		
Impatiens aurella		R1
Ipomopsis aggregata		
Iris pseudacorus	C	
Juncus alpinus		
Juncus articulatus		
Juncus bufonius		
Juncus effusus		
Juncus ensifolius		
Juncus longistylis		
Juncus nodosus		
Juncus saximontanus		
Juncus tenuis		
Juniperus communis		
Juniperus scopulorum		
Koeleria cristata		
Lactuca muralis	x	
Lactuca serriola	x	
Larix occidentalis		
Lathyrus latifolius		
Lathyrus ochroleucus		
Lemna spp.		

Taxon	Non-native / Washington Noxious Weed Status[1]	Washington Rare Plant State Status[2]
Leucanthemum vulgare	B	
Lilium columbianum		
Limosella acaulis		
Limosella aquatica		
Linaria dalmatica	B	
Lindernia dubia		
Linnaea borealis		
Linum lewisii	C	
Listera caurina		
Listera convallarioides		
Listera cordata		
Lithophragma spp.		
Logfia (Filago) arvensis	x	
Lomatium ambiguum		
Lomatium cf geyeri		
Lomatium dissectum		
Lomatium triternatum		
Lonicera ciliosa		
Lonicera involucrata		
Lonicera utahensis		
Lotus purshiana		
Lupinus polyphyllus		
Lupinus sericeus		
Lupinus spp.		
Luzula multiflora		
Luzula parviflora		
Lycopodium complanatum		
Lycopus americanus		
Lycopus spp.		
Lycopus uniflorus		
Lysichitum americanum		
Lysimachia ciliata		
Lysimachia nummularia	x	
Lysimachia thyrsiflora		
Lythrum salicaria	B-designate	
Maianthemum racemosa		
Maianthemum stellata		
Malus spp.	x	
Marsilea vestita		

Table A.1-1, continued...

Taxon	Non-native / Washington Noxious Weed Status[1]	Washington Rare Plant State Status[2]
Matricaria spp.		
Medicago cf falcata	x	
Medicago lupulina	x	
Melilotus alba	x	
Melilotus officinalis	x	
Mentha arvensis		
Mentzelia laevicaulis		
Mimulus guttatus		
Mimulus moschatus		
Mitella spp.		
Moneses uniflora		
Muhlenbergia andina		
Muhlenbergia mexicana var. mexicana		R1
Myosotis arvensis	x	
Myosotis discolor	x	
Myosotis laxa		
Myosotis scorpioides	x	
Myosotis stricta	x	
Myriophyllum spicatum	B	
Nepeta cataria	x	
Oenothera villosa spp. strigosa		
Ophioglossum pusillum		T
Oplopanax horridum		
Orthilia secunda		
Oryzopsis asperifolia		
Osmorhiza chilensis		
Oxalis corniculata	x	
Pachistima myrsinites		
Panicum capillare	x	
Panicum spp.		
Parnassia palustris v. parviflora		
Parthenocissus vitacea	x	
Pellaea glabella spp. simplex		
Penstemon fruticosus		
Phacelia hastata		
Phacelia heterophylla		
Phacelia linearis		
Phalaris arundinacea	C	

Taxon	Non-native / Washington Noxious Weed Status[1]	Washington Rare Plant State Status[2]
Philadelphus lewisii		
Phleum pratense	x	
Physocarpus malvaceus		
Physostegia parviflora		
Picea engelmannii		
Pinguicula macroceras		
Pinus contorta		
Pinus monticola		
Pinus ponderosa		
Piperia elegans		
Piperia unalascensis		
Plagiobothrys scouleri		
Plantago lanceolata		
Plantago major		
Platanthera dilatata		
Platanthera hyperborea		
Platanthera orbiculata		
Plectritis macrocera		
Poa bulbosa	x	
Poa compressa	x	
Poa palustris		
Poa pratensis		
Poa secunda		
Polemonium pulcherrimum spp. pulcherrimum		
Polygonum amphibium		
Polygonum aviculare	x	
Polygonum convolvulus	x	
Polygonum douglasii		
Polygonum lapathifolium		
Polygonum persicaria	x	
Polygonum spp.		
Polypodium hesperium		
Polystichum imbricans		
Polystichum lonchitis		
Populus balsamifera var. trichocarpa		
Populus alba	x	
Populus tremuloides		

Table A.1-1, continued...

Taxon	Non-native / Washington Noxious Weed Status[1]	Washington Rare Plant State Status[2]
Potamogeton cf. gramineus		
Potamogeton cf. pectinatus		
Potamogeton crispus	x	
Potamogeton richardsonii		
Potamogeton spp.		
Potentilla anserina		
Potentilla fruticosa		
Potentilla gracilis		
Potentilla norvegica		
Potentilla palustris		
Potentilla recta	B	
Potentilla spp.		
Prunella vulgaris		
Prunus emarginata		
Prunus virginiana		
Pseudoroegneria spicata		
Pseudotsuga menziesii		
Pteridium aquilinum		
Pteryxia terebinthina var. foeniculacea		
Pyrola asarifolia		
Pyrola chlorantha		
Pyrola picta		
Ranunculus aquatilis		
Ranunculus flammula		
Ranunculus macounii		
Ranunculus repens	x	
Ranunculus spp.		
Ranunculus uncinatus		
Rhamnus purshiana		
Rhododendron albiflorum		
Rhus glabra		
Ribes lacustre		
Ribes laxiflorum		
Ribes lobbii		
Ribes sanguineum		
Ribes spp.		
Rorippa curvipes (obtusa)		

Taxon	Non-native / Washington Noxious Weed Status[1]	Washington Rare Plant State Status[2]
Rorippa islandica		
Rorippa spp.		
Rosa acicularis		
Rosa gymnocarpa		
Rosa nutkana		
Rosa spp.		
Rosa woodsii		
Rubus idaeus		
Rubus leucodermis		
Rubus parviflorus		
Rudbeckia hirta	x	
Rumex acetosella	x	
Rumex crispus	x	
Rumex occidentalis		
Rumex spp.		
Sagina procumbens	x	
Sagittaria cuneata		
Salix bebbii		
Salix exigua		
Salix lucida		
Salix melanopsis		
Salix prolixa (rigida)		
Salix scouleriana		
Salix sitchensis		
Salix spp.		
Sambucus cerulea		
Sambucus racemosa		
Sanicula marilandica		S
Scirpus atrocinctus (cyperinus)		
Scirpus microcarpus		
Scirpus validus		
Scutellaria angustifolia		
Scutellaria galericulata		
Scutellaria lateriflora		
Sedum lanceolatum		
Sedum leibergii		
Sedum spp.		
Sedum stenopetalum		
Selaginella cf. wallacei		
Selaginella densa		
Senecio hydrophilus		
Senecio indecorus		

Table A.1-1, continued...

Taxon	Non-native / Washington Noxious Weed Status[1]	Washington Rare Plant State Status[2]
Senecio spp.		
Senecio triangularis		
Senecio vulgaris	x	
Setaria viridis	x	
Shepherdia canadensis		
Silene cserei	x	
Silene cucubalus	x	
Silene menziesii		
Silene noctiflora	x	
Sisymbrium altissimum	x	
Sisymbrium loesellii	x	
Sisyrinchium septentrionale		S
Sium suave		
Solanum dulcamara	x	
Solidago canadensis		
Solidago gigantea		
Solidago spp.		
Sonchus arvensis	B	
Sonchus uliginosus	x	
Sorbus aucuparia	x	
Sparganium emersum/angustifolium		
Sphenopholis obtusata		
Spiraea douglasii		
Spiranthes romanzoffiana		
Spirea betulifolia		
Sporobolus cryptandrus		
Stachys palustris		
Stellaria calycantha		
Stellaria media	x	
Streptopus amplexicaulis		
Suksdorfia violacea		
Symphoricarpos albus		
Symphytum officinale	x	
Tanacetum vulgare	C	
Taraxacum officinale	x	
Taxus brevifolia		
Thalictrum dasycarpum		S
Thalictrum occidentalis		
Thuja plicata		
Tiarella trifoliata		
Toxicodendron rydbergii		
Tragopogon dubius	x	
Trifolium arvense	x	
Trifolium dubium	x	
Trifolium pratense	x	
Trillium ovatum		
Trisetum canescens		
Trisetum spicatum		
Triteleia grandiflora var. grandiflora		
Tsuga heterophylla		
Typha latifolia		
Ulmus pumila	x	
Urtica dioica		
Utricularia sp		
Vaccinium membranaceum		
Vaccinium spp.		
Verbascum thapsus	x	
Veronica americana		
Veronica anagallis-aquatica		
Veronica chamaedrys	x	
Veronica officinalis	x	
Veronica peregrina var. xalapensis		
Veronica spp.		
Viburnum opulus		
Vicia americana var truncata		
Viola adunca		
Viola glabella		
Viola nephrophylla		
Viola renifolia		S
Viola spp.		
Woodsia oregana		
Xanthium strumarium minus	x	
Zannichellia spp.		
Zigadenus elegans		

Table A.1-1, continued...

Notes:

1 Non-native status from the Washington State Noxious Weed Board
http://www.nwcb.wa.gov/weed_list/weed_list.htm
X = non-native without state status;
A = Class A Noxious Weeds: designated noxious weed that is limited in distribution in Washington. State law requires that these weeds be eradicated;
B = Class B Noxious Weeds: designated noxious weed that is either absent from or limited in distribution in some portions of the state but very abundant in other areas. The goals are to contain the plants where they are already widespread and prevent their spread into new areas.
C = Class C Noxious Weeds: Non-native plants that are already widespread in Washington State. Counties can choose to enforce control, or they can educate residents about controlling these noxious weeds.

2 State Status from the Washington Department of Natural Resources
http://www.dnr.wa.gov/nhp/refdesk/lists/plantrnk.html#key
E = Endangered. In danger of becoming extinct or extirpated from Washington.
T = Threatened. Likely to become Endangered in Washington.
S = Sensitive. Vulnerable or declining and could become Endangered or Threatened in the state.
X = Possibly extinct or Extirpated from Washington.
P1 = Priority 1. Rare nonvascular plant but with insufficient information to assign another rank.
P2 = Priority 2. Nonvascular plant of concern but with insufficient information to assign another rank.
R1 = Review group 1. Of potential concern but needs more field work to assign another rank.
R2 = Review group 2. Of potential concern but with unresolved taxonomic questions.
W = Watch. More abundant and/or less threatened than previously thought

Appendix 2: RTE Location Information Including 2007 Status, Sighting Form Names, and Subpopulations Mapped in the Boundary Hydroelectric Project Study Area, 2007 – Privileged

NOTE: Because of the potentially sensitive nature of information regarding RTE plant species, the information contained in Appendix 2 is not being distributed to the general public. This information has been filed with FERC with a Privileged designation in Volume 7 of the USR submittal. It may be obtained by request to Seattle City Light or FERC, subject to confidentiality provisions.

Appendix 3: WNHP Rare Plant Sighting Forms for RTE Populations on Non-USFS Land, Boundary Hydroelectric Project Study Area, 2007 – Privileged

NOTE: Because of the potentially sensitive nature of information regarding RTE plant species, the information contained in Appendix 3 is not being distributed to the general public. This information has been filed with FERC with a Privileged designation in Volume 7 of the USR submittal. It may be obtained by request to Seattle City Light or FERC, subject to confidentiality provisions.

Appendix 4: USFS Element Occurrence Field Forms for RTE Populations on USFS Land, Boundary Hydroelectric Project Study Area, 2007 – Privileged

NOTE: Because of the potentially sensitive nature of information regarding RTE plant species, the information contained in Appendix 4 is not being distributed to the general public. This information has been filed with FERC with a Privileged designation in Volume 7 of the USR submittal. It may be obtained by request to Seattle City Light or FERC, subject to confidentiality provisions.

Appendix 5: Maps of RTE Plant Polygons Located in the Boundary Hydroelectric Project Study Area, 2007 – Privileged

NOTE: Because of the potentially sensitive nature of information regarding RTE plant species, the information contained in Appendix 5 is not being distributed to the general public. This information has been filed with FERC with a Privileged designation in Volume 7 of the USR submittal. It may be obtained by request to Seattle City Light or FERC, subject to confidentiality provisions.

Appendix 6: RTE Plant Polygons and Potential Impacts, Boundary Hydroelectric Project

Table A.6-1. RTE plant polygons and potential impacts, Boundary Hydroelectric Project, 2007.

Polygon ID	2007 Sighting Form	Ownership	Herbivory Disease, Insects	Rec-reation	Weeds - Low Medium High[1]	Erosion - P (Project) NP (Non-Project)	Project Maint. & Oper-ations
ASMI-3	A	BLM, SCL			L	P	
ASMI-3A	A	BLM			L	P	
ASMI-4	B	Private			M		
ASMI-5	C	USFS, DNR		X	M		
ASMI-5A	5A	DNR			H		
ASMI-6	B	Private, DNR			M		
ASMI-7	B	SCL, Private			M	NP	
ASMI-8	B	PUD#1			M	NP	
ASMI-10	B	DNR, Private			M	NP	
ASMI-11	C	USFS, DNR			M	NP	
ASMI-12	C	USFS, DNR			M	NP	
ASMI-13	B	DNR, USFS			M		
ASMI-14	B	DNR			M	NP	
ASMI-15	B	DNR, USFS			M		
ASMI-16	16	USFS			L	P	
ASMI-17	A	BLM			L		
ASMI-18	B	DNR			M	NP	
CACA-1	1	USFS			L		
CAKR 1	1	BLM			L		
CAFL-1	B	BLM, DNR			M - H		
CAFL-3	B	SCL			M - H		
CAFL-4	B	USFS			M - H		
CAFL-5	B	SCL			M - H		
CAFL-6	B	BLM		X	M - H		
CAFL-7	B	USFS			M - H		
CAFL-8	B	BLM			M - H		
CAFL-10	C	SCL			L		
CAFL-11	C	SCL			L		
CAFL-12	C	SCL			L		
CAFL-13	C	SCL			L		
CAFL-14	C	DNR			L		
CAFL-15	C	SCL			L		
CAFL-16	B	USFS		X	M - H		
CAFL-17	B	USFS			M - H		
CAFL-18	B	USFS			M - H		
CAFL-19	B	USFS			M - H		
CAFL-20	B	BLM			M - H		
CRST-1A	1	SCL			L		
CRST-1B	1	SCL			L		
CRST-1C	1	SCL			L		
CRST-1D	1	SCL			L		

Table A.6-1, continued…

Polygon ID	2007 Sighting Form	Ownership	Herbivory Disease, Insects	Rec-reation	Weeds - Low Medium High[1]	Erosion - P (Project) NP (Non-Project)	Project Maint. & Oper-ations
CRST-2A	A	USFS			L		
CRST-2B	A	USFS			L		
CRST-2C	A	USFS			L		
CRST-2D	A	USFS			L		
CRST-3	3	USFS			L		
CRST-4	4	USFS			L		
CRST-5	A	USFS			L		
DRDR-1A	A	SCL			L		
DRDR-1B	A	SCL			L		
DRDR-2	B	USFS			L		
DRDR-3	B	USFS			L		
DRDR-4	A	SCL, BLM			L		
DRDR-5A	B	USFS			L	NP	
DRDR-5B	B	USFS			L		
DRDR-6A	A	BLM			L		
DRDR-6B	A	BLM			L		
DRDR-9	A	BLM			L		
DRDR-10	A	BLM			L		
DRDR-11	B	USFS			L		
DRDR-12	A	BLM, SCL, Private			L		
DRDR-13	B	USFS, DNR			L		
DRDR-14	A	BLM					
DRDR-15	A	BLM			L		
DRDR-15A	A	BLM			L		
DRDR-17A	A	SCL, BLM, DNR			L		
DRDR-17B	A	DNR, BLM			L		
DRDR-18	A	BLM			L		
DRDR-19	A	BLM		x	L	P	
DRDR-20	A	BLM, SCL			L		
DRDR-21A	B	USFS			L		
DRDR-21B	B	USFS, DNR			L		
DRDR-21C	B	USFS			L		
DRDR-21D	B	USFS			L		
DRDR-22	A	BLM			L		
DRDR-23	A	SCL			L		
DRDR-24a	B	USFS			L		
DRDR-24b	B	USFS			L		
DRDR-24c	A	SCL			L		

Table A.6-1, continued…

Polygon ID	2007 Sighting Form	Ownership	Herbivory Disease, Insects	Rec-reation	Weeds - Low Medium High[1]	Erosion - P (Project) NP (Non-Project)	Project Maint. & Oper-ations
DRDR-25A	C	USFS			L		x
DRDR-25B	C	USFS, DNR			L		x
DRDR-26	C	USFS			L		x
DRDR-27	C	USFS			L		x
DRDR-28	C	USFS			L		x
DRDR-29	C	USFS			L		x
DRDR-30	30	USFS			L		x
HIOD-1	A	SCL			L		
HIOD-2	A	SCL, DNR		x	L		
HIOD-3	3	SCL			H		
HYMA-1	A	DNR			M		
HYMA-2	A	DNR			M		
HYMA-3	A	DNR			M		
HYMA-4	A	DNR			M		
HYMA-5	A	DNR			M		
IMAU-4	4	USFS			M	P	
IMAU-5	5	BLM, SCL			H		
IMAU-6	6	SCL			H		
IMAU-7	7	DNR, Private, Metaline			H		
IMAU-8	8	USFS			M		
IMAU-9	9	SCL			M		x
IMAU-10	10	SCL			H		
IMAU-11	11	Private			H		
MUME-2	A	BLM			M - H		
MUME-3	A	BLM,DNR		x	M - H		
MUME-4	A	BLM		x	M - H	P	
MUME-5	A	SCL			M - H		
MUME-6	A	USFS			M - H		
MUME-7A	A	BLM, SCL			M - H		
MUME-7B	A	SCL			M - H		
MUME-8	A	USFS		x	M - H		
MUME-9	A	USFS			M - H		
MUME-10	A	BLM		x	M - H	P	
MUME-11	A	BLM			M - H		
MUME-12	A	SCL			M - H		
MUME-13	A	BLM			M - H		
MUME-14	A	BLM		x	M - H		
MUME-15a	A	BLM		X	M - H	P	
MUME-	A	BLM			M - H		

Table A.6-1, continued…

Polygon ID	2007 Sighting Form	Ownership	Herbivory Disease, Insects	Rec-reation	Weeds - Low Medium High[1]	Erosion - P (Project) NP (Non-Project)	Project Maint. & Oper-ations
15b							
MUME-16	A	USFS			M - H		
MUME-17	A	SCL			M - H		
MUME-18	A	USFS			M - H		
MUME-19	A	USFS			M - H		
MUME-20	A	SCL		x	M - H		
MUME-21	A	BLM			M - H		
MUME-22	A	SCL			M - H		
MUME-23	A	USFS			M - H		
OPPU-1	1	SCL			H		
OPPU-2	2	BLM			H		
SAMA-1	1	USFS			L		
SAMA-4	4	BLM			M		
SAMA-5	5	USFS			L		
SAMA-6	6	USFS			L		
SAMA-7	7	USFS			M		
SAMA-8	8	USFS			L		
SAMA-9	A	SCL			L		x
SAMA-10	A	SCL			L		x
SAMA-11	A	SCL			L		x
SAMA-12	12	USFS			L		x
SISE-2	2	BLM		x	H		
SISE-3	A	SCL			H		
SISE-4	A	BLM			H		
THDA-1	B	SCL	x		M - H		
THDA-2	A	USFS			M - H	P	
THDA-2A	A	USFS		x	M - H		
THDA-3	A	USFS			M - H		
THDA-4	A	USFS			M - H	P	
THDA-5	A	USFS		x	M - H		
THDA-6	A	USFS			M - H		
THDA-8	B	BLM, SCL			M - H	P	
THDA-9	C	DNR, Private, WSDOT, Selkirk School			M - H		
THDA-9A	C	DNR, Private			M - H		
THDA-10A	10	DNR, SCL, Private			H		
THDA-10B	10	SCL, DNR			H		
THDA-10C	10	SCL			H		
THDA-11	B	BLM		x	M - H		

Table A.6-1, continued…

Polygon ID	2007 Sighting Form	Ownership	Herbivory Disease, Insects	Rec-reation	Weeds - Low Medium High[1]	Erosion - P (Project) NP (Non-Project)	Project Maint. & Oper-ations
THDA-12	B	BLM		x	M - H		
THDA-13	B	BLM, SCL	x		M - H	P	
THDA-14	B	SCL, BLM,DNR		x	M - H		
THDA-20	C	DNR			M - H	NP	
THDA-21	A	USFS			M - H		
THDA-22	A	USFS			M - H		
THDA-23	B	SCL	x		M - H		
THDA-24	B	BLM			M - H	P	
THDA-25	B	BLM		x	M - H	P	
THDA-26	A	USFS			M - H		
THDA-27	27	USFS			H		
THDA-28	B	BLM			M - H		
THDA-29	C	DNR			M - H	NP	
THDA-30a	B	BLM		x	M - H		
THDA-30b	B	BLM			M - H		
THDA-31a	B	SCL			M - H		
THDA-31b	B	BLM			M - H		
THDA-32	B	BLM			M - H		
THDA-33	A	USFS			M - H	P	
THDA-34	A	USFS			M - H		
THDA-35	A	USFS			M - H		
THDA-36	B	SCL			M - H		
THDA-37	A	USFS			M - H		
THDA-38	A	USFS, SCL			M - H	P	
THDA-39	A	USFS			M - H	P	
THDA-40	B	SCL			M - H		
THDA-41	B	BLM			M - H		
THDA-42	B	BLM		x	M - H		
THDA-43	B	BLM		x	M - H		
THDA-44	B	SCL, BLM,DNR			M - H		
THDA-45	B	BLM			M - H		
THDA-46	C	DNR, Metaline, SCL		x	M - H		
THDA-47a	C	BLM, DNR, Private, Metaline		x	M - H	NP	
THDA-47b	C	DNR, Private			M - H	NP	
THDA-48	C	DNR, WSDOT, Private			M - H		
THDA-49A	C	DNR, WSDOT, Private			M - H		
THDA-49B	C	DNR			M - H		
THDA-	C	DNR, Private			M - H		

Table A.6-1, continued…

Polygon ID	2007 Sighting Form	Ownership	Herbivory Disease, Insects	Rec-reation	Weeds - Low Medium High[1]	Erosion - P (Project) NP (Non-Project)	Project Maint. & Oper-ations
49C							
THDA-50	50	SCL DNR			L		
THDA-51	50	SCL DNR		x	L		
THDA-52A	B	SCL		x	M - H		
THDA-53	53	SCL			M - H		
THDA-54	B	SCL			M - H		
THDA-55	B	BLM			M - H		
THDA-56	C	Metaline, SCL		x	M - H		
THDA-57	C	Private			M - H		
THDA-58	C	SCL, DNR, Private			M - H		
VIRE-1	1	USFS		x	L		
VIRE-3	3	USFS			L		
VIRE-4	4	BLM		x	L	P	
VIRE-5	5	BLM			L		
VIRE-6	6	USFS			M		x

Note:
1 Estimated % cover of weeds in general vicinity of RTE plant subpopulations:
Low 0–10% cover
Medium 11–50% cover
High 51–100% cover
BLM – Bureau of Land Management
DNR – Washington State Department of Natural Resources
SCL – Seattle City Light
USFS – U.S. Forest Service
WSDOT – Washington State Department of Transportation

Appendix 7: Erosion Effects on RTE Plant Polygons, Boundary Hydroelectric Project, 2007 – Privileged

NOTE: Because of the potentially sensitive nature of information regarding RTE plant species, the information contained in Appendix 7 is not being distributed to the general public. This information has been filed with FERC with a Privileged designation in Volume 7 of the USR submittal. It may be obtained by request to Seattle City Light or FERC, subject to confidentiality provisions.